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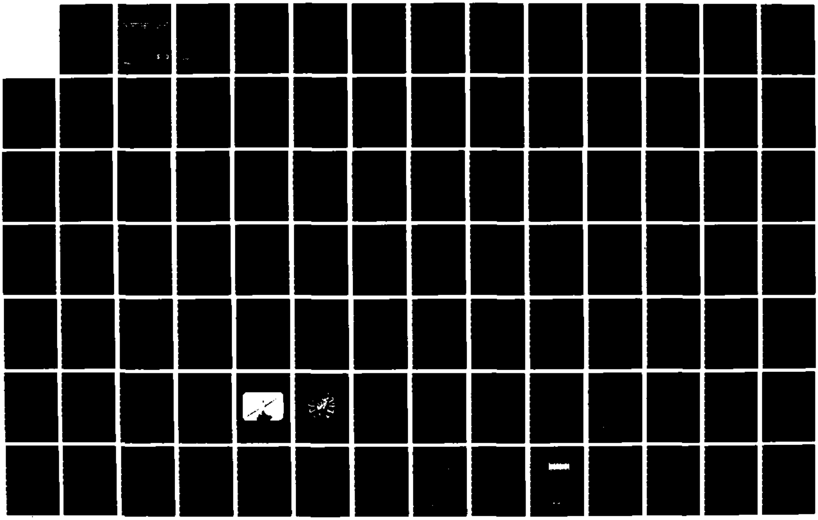

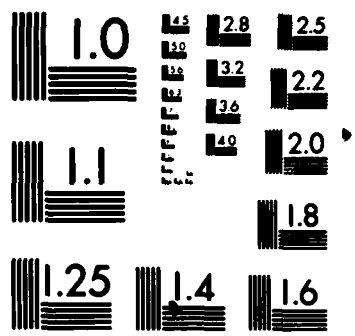

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AN EXPERIMENTAL INVESTIGATION OF THE STRUCTURAL DYNAMICS OF A TORSIONALLY SOFT ROTOR IN VACUUM

A.V. Srinivasan, D.G. Cutts and H.T. Shu

CONTRACT NAS2-11942
July 1986

NASA

NASA CONTRACTOR REPORT 177418

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QUALITY INSPECTED 1

Prepared for
Aeroflightdynamics Directorate
U.S. Army Aviation Research and Technology Activity
Moffett Field, CA 94035
Under Contract NAS2-11942
July 1986

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AN EXPERIMENTAL INVESTIGATION OF THE STRUCTURAL DYNAMICS OF A TORSIONALLY SOFT ROTOR IN VACUUM

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AN EXPERIMENTAL INVESTIGATION OF THE STRUCTURAL DYNAMICS OF A TORSIONALLY SOFT ROTOR IN VACUUM

SUMMARY

An extensive data base of structural dynamic characteristics has been generated from an experimental program conducted on a torsionally soft two-bladed model helicopter rotor system. Measurements of vibratory strains for five modes of vibration were made at twenty-one locations on the two blades at speeds varying from 0 to 1000 RPM and for several combinations of precone, droop and flexure stiffness. The tests were conducted in vacuum under carefully controlled laboratory conditions using a unique excitation device which uses a system of piezoelectric crystals bonded to the blade surface near the root. Frequencies, strain mode shapes and dampings are extracted from the time histories and can be used to validate structural dynamics codes. The dynamics of the system are such that there is a clear tendency for the first torsion and second flap modes to couple within the speed range considered. Strain mode shapes vary significantly with speed and configuration. This feature is important in the calculation of aeroelastic instabilities. The tension axis tests confirmed that the modulus-weighted centroid for the nonhomogeneous airfoil is slightly off the mass centroid and validated previous static tests performed to determine the location of the tension axis.

INTRODUCTION

An accurate knowledge of the dynamic characteristics of rotor blades is essential in order for the designer to be able to determine the extent of susceptibility of the rotor system to aeroelastic instabilities . These dynamic characteristics include the natural frequencies, mode shapes and damping of both the individual blades and rotor system. A data base of these characteristics experimentally obtained under controlled excitation for different configurations of the rotor obtained (covering a range of pitch, precone and droop settings at several rotor speeds) can be used to validate structural dynamic analysis models.

Accurate measurements of the structural dynamic characteristics in air or in an operating environment cannot be made because of the influence of aerodynamic damping. In nearly all rotor experiments, modes which exhibit high aerodynamic damping are virtually impossible to measure. Further, aeroelastic coupling among the blade modes produces responses which do not represent directly the basic natural system mode characteristics of the rotor blades. Therefore it becomes essential to obtain by measurement the fundamental modes and their characteristics in a vacuum environment and to use these data to validate analytical models. The validated models can then be used with confidence in the design-analysis process.

A motivation for the present effort comes from the results presented at the methodology assessment workshop (Ref. 1) in which wide variation and discrepencies between test data and corresponding aeroelastic analyses of hingeless rotor models were reported by participants from industry and government. The validation of the isolated structural dynamics component of a rotor system mathematical model is an important step in developing an aeroelastic computer code that can be used with a high level of confidence.

This report presents the results of an effort to experimentally determine the structural dynamics of a torsionally soft 6.32 foot diameter two bladed rotor system in vacuum. Frequencies, mode shapes and damping for the first three flap bending modes, first torsion mode and the first lead-lag mode were measured in vacuum at speeds varying between 0 and 1000 RPM covering a range of droop, precone, pitch angle and pitch flexure combinations as follows:

Droop 0, -5°

Precone 0, $+5^{\circ}$,

Pitch 0, $+12^{\circ}$, -12°

Pitch Flexures: Soft and stiff

With 21 strain gages distributed at selected spanwise locations on the two blades, a total of nearly 4000 time histories were recorded for analysis at each speed. The blades used are the same blades which were tested by Sharpe, 1986 (Ref.2), in order to establish the Flap-Lag-Torsion aeroelastic stability of the rotor. Reference 2 presents, in much more detail the background of this important problem area and serves as the basis for the investigation reported here. The only other attempt made in this regard is by Lee (Ref. 3) but the method of excitation used was such that torsional characteristics could not be obtained accurately. The uniqueness of the present effort lies in the use of an excitation device which can excite a desired mode using a system of properly positioned piezoelectric crystals. The crystals are bonded to the blades and under a sinusoidal power input, experience alternating strains which in turn are imparted to the blades through the bond. This results in a clean and reliable method of exciting the blades at their resonances. This system has been found to be effective in exciting the first five modes of the rotor system. The system is described in detail later in this report. Vibratory data has been recorded from strain gages for all test configurations at 0 and 1000 RPM and at three intermediate speeds for some configurations. The data were reduced using Fast Fourier Transform (FFT) techniques and a modal curve fitting procedure.

An accurate assessment of steady bending and torsion loads cannot be made without accurately locating the blade tension axis along the chord. This experimental program therefore, included measurement of the position of the tension axis (i.e. the position of the modulus-weighted centroid along the chord; an important section property of nonhomogeneous structural members) for the baseline configuration.

The report presents the details of the program, a discussion of results obtained along with principal conclusions reached.

TEST OBJECTIVES

The specific test objectives of this program were: (a) to determine the location of the tension axis of a specific blade of the rotor system in vacuum at speeds up to 1000 RPM by measuring the static lead-lag bending strain distribution, and hence bending moments, (b) to obtain the dynamic characteristics, namely strain mode shape, natural frequency and modal damping for the first five modes of the rotor by measuring the distribution of dynamic strains at predetermined locations on the blades while spinning at speeds up to 1000 RPM in evacuated conditions, and (c) to determine, through such measurements, the influence of precone, droop, pitch and pitch flexural stiffness.

ROTOR MODEL

As shown in Figure 1, the rotor model selected for the proposed study is a 6.32ft diameter isolated hingeless two bladed rotor model with a NACA 0012 airfoil having no twist or taper. This rotor constitutes configuration IIA as used in the Integrated Technology Rotor/Flight Research Rotor (ITR/FRR) Methodology Assessment Study (Ref. 1). The rotor was originally used for aeroelastic stability studies reported in Reference 2, and is described in detail therein. The blade construction outboard of the 9.5% radius consists of a unidirectional Kevlar spar and 0.003 inch (.0762 mm) thick glass fiber cloth skin. The blade profile is maintained by a polyurethane foam core. Inboard of the 9.5% blade radius, the flexible blade is bonded into an airfoil shaped aluminum alloy cuff attached to the root flexures at the hub. Embedded in the leading edge are tantalum segments for center-of-gravity and cross sectional polar moment of inertia control. The cross-sectional properties were designed so that the center of gravity and the elastic axis are coincident with the quarter chord point.

The dimensionless lead-lag and first flap blade frequencies, (1.5 and 1.13 respectively), are representative of typical hingeless full scale rotors but the dimensionless first torsion mode frequencies, (2.87 with the stiff flexure and 2.56 with the soft flexure), are less than typical full scale values. The dimensionless frequencies were obtained by dividing the natural frequencies by the nominal rotor speed of 1000 RPM.

The rotor hub design permits variation of the pitch flexure (control) stiffness, along with the precone, droop and pitch angles. Two pitch flexures were used in the tests. The relatively soft one had a torsional stiffness 7.062 times that of the blade whereas the stiff one was almost 10000 times stiffer than the blade. Interchangeable hubs provided the precone angles of 0 and 5 degrees as required in the testing. The required droop angles of 0 and -5 degrees were obtained by having interchangeable wedges positioned between the blade cuff flange and the outboard face of the pitch flexure. Pitch angle settings of -12, 0 and 12 degrees for testing were obtained by rotating the blade outboard of the pitch flexure, at the interface between the pitch flexure and the droop wedge.

The six basic rotor configuration cases that were investigated are shown in Figure 2. These were selectively combined with the three test pitch angles to give the twelve selected test configurations for which vibration data were obtained.

VACUUM SPIN RIG

The UTRC Centrifugal Testing Facility (Spin Rig) was designed from its inception as a research tool dedicated to measurement of the in-vacuo structural dynamics of rotating blade assemblies. As shown in Figure 3, this rig is an above-ground facility with a test chamber measuring approximately ten feet in diameter and three feet in height. Principal mechanical features of the spin rig are the vacuum pump system and the rotor drive system.

The vacuum pump system evacuates the test chamber down to 100 millitorrs in less than 8 minutes. An automatic vacuum valve will isolate the test chamber to prevent air leaking in should a power failure occur.

The drive system consists of an 8-inch Barbour-Stockwell air turbine and its associated electro-pneumatic servo control throttle valve which is able to maintain required speeds at better than ± 1%. The bottom flange of the turbine is fitted with a magnetic pickup and a 60 tooth gear to provide the signal to the speed control unit. A safety interlock system protects against any loss of oil pressure, oil flow, or oil level in the reservoir. A remotely operated turbine brake control will function in the event of a power failure. An overspeed trip solenoid air valve will shut off the drive air when the selected value of maximum speed is attained.

A unique feature of the facility is the base mounted rotor drive assembly which provides complete accessibility to the model rotor and unobstructed viewing through the lid from above. Figure 4 shows the conceptual arrangement of the model rotor installation in the test facility. The model was mounted to the top of the drive shaft using a special adapter. The drive shaft rotates in a squeeze film damper bearing incorporated in the sealed duplex bearing assembly mounted beneath the rig floor. The lower end of the shaft is connected to the air turbine using a flexible coupling. A 40-channel slip ring unit is similarly connected to the lower end of the turbine shaft. Figure 5 shows the model rotor mounted in the spin rig. Prior to testing, with the model mounted on the shaft, the rig model frequencies, were determined using an instrumented hammer and signature analysis methods. The lowest frequency found was 88 Hz for a shaft bending mode in the direction of the blade radial axis. This frequency is above the minimum recommended in order to preclude the dynamic coupling between the rig and the rotor blade lead-lag motion from contaminating isolated blade frequency and damping measurements.

Initial runs were made to 980 RPM with the chamber evacuated down to 300 millitorrs. No indication for the need of balancing was evident.

PIEZOELECTRIC CRYSTAL EXCITATION SYSTEM

The research objectives of this program required that the technique chosen for the excitation of rotor systems should be one in which the level, frequency, and phase characteristics of excitation can be controlled. In this way, the individual modes of each blade and of the rotor could be excited at speed, to permit determination of the modal parameters from resulting response data. The Piezoelectric Crystal Excitation System developed at UTRC satisfies this requirement and was used in this program.

The piezoelectric crystal, by virtue of its unique electromechanical properties, is ideally suited for exciting structures with minimum modification of the structural mass and stiffness properties and can be used in both rotating and nonrotating tests. Piezoelectric crystals have previously been successfully used as structural exciters in studies of bladed disk forced vibrations (References 4 and 5). In the above applications piezoelectric crystals were used also as transducers to measure strain in the various structures. Excitation by crystals can be effected in two ways. In the first, a crystal sandwich is positioned between two components of the structure such that when a voltage is applied to the faces of the crystal, relative motion between the components results. Disadvantages of this method are the change in stiffness of the structure that occurs at the crystal-structure junction and the high excitation voltages required. In the second, an elongated crystal wafer is bonded to the surface of the structure such that when a relatively low voltage is applied to the crystal, a longitudinal strain is imparted to the surface which in turn produces a local bending moment about the neutral axis and so bends the structure. This method is obviously best suited to excite plate-like structures and was thus selected for the present application.

Crystal wafers are attached to the blade surface at locations where significant strains are expected in the modes of interest. Each blade is instrumented in this way and the crystal installations become a permanent feature of the blade assembly. Electronic circuitry has to be provided to enable the phasing between each blade exciter and input power level to be varied as required. Thus, blade modes and rotor modes can be excited.

A UTRC designed and fabricated excitation control unit provides for independent level and phase control of the a.c. voltage supplied to each of the crystals on the blades. This independent control of the phase angle between the crystals permits the optimum excitation of each mode, both symmetric and antisymmetric. Such values are dialled in for each channel at the master control panel. Phase angle is variable from 0 to 360 degrees in steps of 1.41 degrees. The amplitude control to each channel is continuously variable from 0 to 140 volts peak. The signal generator used is a Hewlett Packard Model HP 3311A with an external control unit to allow very fine frequency tuning. The $\pm$ 150 volt d.c. power was supplied by two NjE Model EA160-8 units.

The piezoelectric drive crystals attached to the blades for the present test program were of G1356 material supplied by Piezo Electric Products. They were made of lead zirconate titanate ceramic material with nickel surface electrodes. The elements, nominally measuring 1.0 x 0.5 x 0.010 inch, were epoxied directly to the upper surface of each blade as close to the cuff as possible. Two drive elements were attached to the upper surface of each blade, one above the spar and one at the trailing edge as shown in Figure 6. These locations were chosen in order to maximize excitations of all the bending and torsion modes of interest with minimum disruption of the original section properties. Two wires from each crystal were routed to terminal strips bonded onto the cuff. From these, connections were made to coaxial cables which were routed down the drive shaft to connect with the four channel control console via slip rings.

INSTRUMENTATION

In order to measure steady bending moments at two locations on the blade and distributed vibratory blade response, two sets of instrumentation and data acquisition systems were utilized. In both cases, the required parameters were derived from the output of skin-surface mounted strain gages.

For the bending moment measurements used to locate the tensile axis, blade S/N 5 was instrumented with the same system of gages as was used in the stability investigation reported in Reference 2, i.e., the gages were mounted near the cuff in a conventional four arm bridge arrangement to measure blade flap, lead-lag and torsional moments. The flap and lead-lag gages were at 12% blade span and the torsional gages were at 14% span. Additional gages however, arranged to measure lead-lag moments, were located at 34% span. The gages were Micro Measurements type CEA-06-187 UW-350 (for flap and lead-lag) and CEA-06-187UV-350 (for torque).

The strain gage leads were routed through the center of the drive shaft and turbine to the slip ring unit and then connected to the bridge excitation and signal conditioning system. This system was the front end portion of the Analog Data Recording System (ARES). This is a semi-portable system for the automatic acquisition of static and dynamic test data with oscillatory frequency rates from zero to 20 kHz. A maximum of 28 analog signals can be processed. Each channel incorporates independent signal conditioning and amplification. The signal conditioners were specifically designed for strain gage type transducers and provide regulated excitation up to 10 volts. The amplifiers provide voltage amplification of 1, 10, 100 or 1000, and are each equipped with low pass signal filters with roll off frequencies of 10Hz, 100Hz, 10kHz, and 100kHz. Signal monitoring was achieved through a single channel selectable digital display readout which includes RMS measurement capability for averaging dynamic signals. The excitation voltage used was 2.0 volts. The conditioned analog signals were then digitized using a Perkin Elmer PE3220 computer controlled data acquisition unit and the steady state responses tabulated.

Calibration of the gages was accomplished directly by applying forces and moments, using a system of weights at the blade tip, and recording gage output with the blade stationary.

For the vibratory measurements one blade, S/N 8, was instrumented extensively with strain gages at 16 locations for modal identification purposes, while the other blade, S/N 5, had gages at five locations near the root for determining modal frequencies and damping and to assess coupling between the blades.

Pretest calculations were performed to assist in locating the gages such that sets of gages would be sensitive to particular types of modes, i.e.flap, edgewise or torsion, and give a reasonable estimate of the span-wise distribution of dynamic strains in each mode.

The principal analytic tools used were the E159 preprocessor and the coupled mode (eigensolution) calculation portions of the G400 rotor aeroelastic analysis (Ref. 6). The E159 preprocessor portion of G400 calculates, from distributions of section properties, the uncoupled flatwise, edgewise and torsion normal modes. Uncoupled modes are defined to be those calculated from omitting pitch, twist, droop and precone effects. These effects were modeled using the coupled mode eigensolution calculation portion of G400. The mass and stiffness data, shown in Table 1, were distributed over 20 blade segments in a format compatible with G400 requirements. The node point locations for these segments are shown in Figure 7. The flexure was located at the first blade segment, taken just outboard of the hub. The area radius of gyration distribution along the blade was approximated by using the torsional inertia and mass of each segment.

The uncoupled bending and torsion modal characteristics of the blades were determined for each of the two pitch flexures at rotor speeds of 150, 400, 600, 900 and 1000 RPM using the E159 routine. A tabulation of the natural frequencies calculated for the first three flap and first edgewise and torsion modes versus speed is given in Table 2. In order to obtain coupled modal characteristics it was essential to include precone, pitch and center of gravity offset in the blade equilibrium calculations. This made it necessary to calculate time-history solutions prior to the calculation of the eigenvalues. The blade precone angle was defined to be the built-in angle which the blade pitch axis makes with the plane of rotation due to hub orientation at the root. Blade droop was defined as the built-in coning outboard of the pitch change bearing. Using these inputs, sample calculations were made. Difficulties were experienced with unstable solutions resulting in excessive amounts of pitch and droop for the soft flexure at high speed. Also the complex mode shapes showed an unreasonable amount of torsion in many of the modes. The frequencies however, agreed well with those of the uncoupled analysis. Further investigation of these problems was beyond the scope of the effort. Therefore, all decisions on gage location were based on the results from uncoupled analyses.

The uncoupled displacement mode shapes were examined for node position change with configuration and speed. These node excursions are shown in Figure 7. The strain gage locations were chosen on the basis of maximum strain for a given type of mode with minimum response in the other types of mode. The selected locations on blade S/N 8 are shown in Figure 7 and 8. Four locations (#1, 2, 3, & 4) along the spar were selected to identify the flap modes. These were in a half-bridge hookup with a gage on the upper and lower surfaces. Three locations (#5, 6 &7) along the trailing edge on the lower surface were selected for edgewise mode identification. These were connected in a single-arm bridge arrangement using a 350 ohm resistor in the other arm. For torsion mode identification, three locations (#8, 9, 10 - #11,12, 13 - #14, 15, 16) were selected and a rectangular rosette, comprising three single-arm gages, was attached to the upper surface at each location. On blade S/N 5, the locations closest to the cuff were gaged, namely #1, 5, 8, 9, & 10.

The strain gages selected were Micro Measurements type EA-13-250BF-350 (single gage) and type EA-13-250RD-350 (rosette). Prior to instrumentation of the blades, the thermal integrity of a candidate strain gage was checked in vacuum using a gage on the spare blade. The gage (type CEA-XX-187W-350 with a grid area of 0.034 sq inch approx) was instrumented with a 1 mil K-type thermocouple connected to a data acquisiton unit. A voltage of 6.7 volts was applied across the gage in a half-bridge connection simulating the proposed test conditions using strain gage amplifier modules. In air, the steady state temperature measured was 120 degrees F and at a reduced pressure of 100 millitorr, the temperature rose and stabilized at 131 degrees F. It was concluded that the selected strain gages would be suitable for the proposed testing.

Signal conditioning was accomplished using twelve UTRC designed and built units mounted radially in the hub-to-shaft adapter as shown in Figure 5. These precalibrated units provided the half-bridge completion network, excitation voltage (6.9 volts), signal amplication (~430) and multiplexing switching control. (7 input channels, 1 output channel). Onboard amplification was required to minimize cross-talk between the strain gage signal leads and the crystal exciter supply wires going up through the center of the drive shaft.

The strain signals were filtered, digitized and recorded on magnetic tape by the computer controlled UTRC Aeromechanical Transient Logging System (ATLAS). For the present tests sampling rates of from 100 to 4000 samples/second were used to cover the required frequency range. The maximum number of data channels that could be acquired simultaneously by the ATLAS was twelve. In order to obtain correlated data from all twenty one strain sensors, a multiplexing system was employed. The strain gages were grouped into three sets with three reference gages common to all sets. The reference gages selected were at locations #1, 5, and 9. The allocation of channels in each set is shown in Table 3. When the command to acquire data was given to the ATLAS computer, the multiplexing switches in the on-board signal conditioner units were set and strains were recorded from each set consecutively as directed by the computer.

In order to allow an independent determination of modal characteristics from the dynamic tests, analog data were obtained from the "static" set of gages on blade S/N 5 and gage #1 on blade S/N 8. These time histories were recorded on magnetic tape using a Bell and Howell Datatape VR3700B F.M. recorder. A triggered pulse was simultaneously recorded to mark the start of each transient event. The set up parameters and channel assignments are given in Table 4.

DESCRIPTION OF TESTS

Neutral Axis Location Tests

The objective of these tests was to determine the lead-lag moment caused by the tensile axis center-of-gravity offset without the influence of aerodynamics.

Prior to spin testing, the moment sensitive gages on blade S/N 5 were calibrated by directly applying forces and moments using a system of weights at the blade tip and recording gage output with the blade stationary. The calibration determined for the lead-lag bridge was 2.33 ft-lb/mv.

The rotor was then spun up and the output of the lead-lag bridge was recorded at speeds of approximately 200, 400, 600, 800 and 1000 RPM.

Vibratory Modal Characteristics

The objective of this series of tests was to identify, for each of twenty four distinct mechanical rotor configurations and four pitch angles, the eight lowest blade hub-fixed natural modes in terms of strain mode shape, natural frequency and damping values. Twelve configurations were tested and these are listed in Table 5. The case numbers correspond to the ITR Configuration II-A cases with subcases indicated by (a), (b) or (c) relating to the pitch angle used. Three pitch angles were tested (-12, 0 and 12 degrees). In general, data were recorded for the first three flap (1F,2F,3F), first edgewise (1E), and first torsion (1T) modes at the zero speed condition and at 1000 RPM. Data at intermediate speeds were recorded for two basic configurations.

Initial tests were performed to determine the optimum phasing of the drive crystal signals to excite all the required modes and in particular, the differential edgewise or lead-lag mode. The collective lead-lag mode was not intentionally excited.

The procedure to obtain a data record required the rig to be first stabilized at a specified speed. Then the crystals were energized at a specified voltage level and phasing. To find the system frequency, a responsive strain gage channel was monitored visually on an oscilloscope as the exciter frequency was swept slowly about the expected frequency of interest. When it was seen that the blade response was at a maximum, other gages were switched on and observed. By noting their amplitudes and

phasing, the mode excited could be identified. At this point, the excitation was switched off and data for one set of gages were acquired and recorded on magnetic tape. Data from the remaining two sets of gages were recorded for the identical conditions in the same way. Table 5 shows the order in which the tests were performed giving the configuration, speed, record number of each datapoint and the modes for which data were obtained.

Throughout the test program, a problem in the vacuum rig drive train caused an undesirable one-per-rev excitation which contaminated the crystal generated transient response data. The rotor response characteristics were composed of one-per-rev and higher harmonics, not only in the lead-lag torque mode but also in the flap and torsion modes through coupling. Particular difficulties were experienced at speeds where natural frequency order line coincidence occurred i.e., at 600 to 800 RPM (edgewise and torsion modes) and at 1000 RPM (torsion mode). It was later determined that a possible source of the roughness was a slightly damaged squeeze film damper bearing.

Following the tests on the spin rig, the dynamic gages on blade S/N 8 were calibrated in a bench test, by statically loading the tip of the blade with a series of forces and moments. The resulting sensitivities at each location for flap wise, edgewise and torsional loadings are given in Table 6 Rotor configuration was configuration #1 with zero pitch.

DATA REDUCTION

Vibratory Modal Characteristics

Data reduction programs, as described in Appendix A, were used to extract the natural frequency, damping, amplitude and phase from each recorded strain response time history. These results were then compiled and presented in tabulated form as shown in Tables 7 to 35. Because of the large number of time histories (nearly 4000) to be processed, certain rejection criteria were written into the program to remove obviously anomolous response data. The removal is indicated by a zero value in the amplitude and phase columns.

Inspection of the dynamic strain gage post-test calibration as shown in Table 6 indicates an obvious inconsistency in the sense of gages #1, 2, 3, and 4 with the convention that tension is positive for each gage. These gages were the only ones connected in a two-gage half-bridge configuration which accounts for the sense change. In the data reduction therefore, the signs of the conversion factors used for these gages were changed. Examination of preliminary results for mode shapes indicated that the sense of gage #8 was incorrect although no cause could be found. However, to make the mode shapes as tabulated more logical, the sign of the conversion factor for gage #8 was also changed.

DISCUSSION OF RESULTS

Neutral Axis Location Tests

The millivolt readings were converted to measure moments using the previously determined calibration factors. In order to relate these results with those measured statically by Sharpe in Reference 2, the equivalent tensile loads applied at the measuring section were determined for each of the speeds using the given weight distribution (see Table 1) for the blade. The measured moments are shown plotted against these equivalent tensile loads in Figure 9. The speed scale is also shown for reference. The "best fit" line through the static results obtained by loading the blade with radial forces applied at the quarter chord point at the tip as shown in Figure 49 of Reference 2 is also shown in Figure 9.

As can be seen, the slopes of the static and spin test results are essentially the same indicating that the methods are equivalent. Thus the determination of the tension axis location described in Reference 2 is valid.

Vibratory Modal Characteristics

The measured modal parameters (frequencies, damping and strain mode shapes) for the five modes and for all the test configurations and speeds are tabulated and presented in Tables 7 through 35. In each of these tables, the natural frequencies for both blades are shown. The mode shapes have been normalized with respect to a reference gage appropriate to each mode. The reference gage number and the normalizing factors (amplitude and phase) are shown at the bottom of each column. By normalizing on the same gage in each multiplexed set of strain data and relying on the fact that each time history was recorded at the same point relative to the input signal, a set of correlated values for all gages on the rotor is obtained. The results for blade S/N 5 are normalized separately and shown in a separate column in each table. The phase angles within $\pm$ 10 degrees of 0 or 180 degrees are rounded off to either 0 or 180 degrees respectively.

The natural frequencies for all configurations and at all speeds are tabulated and shown separately in Table 36 through 40. Variation of the natural frequencies with respect to rotor speed is represented in Figures 10 and 11 for three selected configurations only (Configurations 1(a), 2 and 6 (c)). Refer to Table 5 for the definition of each configuration. Strain mode shapes for each mode in these three configurations are represented in Figures 12 through 17.

The following observations are made with reference to the figures and tables discussed above:

Some results from the experiments, while confirming certain features that were expected, also help establish the validity of data. For example, the frequencies of flap modes increase significantly with rotor speed, whereas the frequencies of torsion and edgewise modes are less sensitive to speed. Similarly, flexure stiffness influenced the torsion mode frequency

more significantly than the bending mode frequency.

Modal strains have been normalized with respect to an "appropriate" reference gage selected at the start of the program for the purpose of correlating the three multiplexed sets of data. However, the complexity of strain distribution in the higher order and/or highly coupled modes causes other gage locations to have higher output at times. Therefore, the tabulated data and the graphical presentations occasionally show normalized strains larger than 1.0. This can be seen in Figure 17 where large edgewise strains influence the coupled "first torsion" mode.

Large edgewise strains are evident in the first torsion mode at high rotor speeds. These strains are two to three times the magnitude of the reference strain (gage #9). These strains appear to be larger for the stiff flexure configurations. During the tests, difficulty was experienced in exciting distinct modes around 800 RPM. This is where the predominantly first torsion and the predominantly second flap modes coalesce. Examination of Table 10 indicates that the modes at 48.5 and 49.4 Hz shown in Figure 10 are essentially the same i.e., a highly coupled second flap mode with a large first torsion component. Apparently, the first torsion mode was not sufficiently excited and consequently, was not recorded.

The measured second flap and first torsion modes are not pure modes and this feature is evident even at speeds removed from that at which the frequencies coalesce. For example, at 600 RPM the nominal second flap mode contains 27% torsion and the nominal first torsion mode contains 114% bending strain content. These reach 118% and 70% respectively at 800 RPM and continue to maintain this highly coupled nature at 1000 RPM.

Structural damping measured in all the modes was found to be low (less than 1% critical).

CONCLUSIONS

Basic vibratory characteristics have been measured for the two bladed helicopter rotor blade system under carefully controlled laboratory conditions. The vibratory strain and frequency data taken over a range of speeds up to 1000 RPM for several combinations of precone, droop and flexure stiffness can be used to calibrate structural dynamic analyses codes. Strong coupling exists between modes (especially between torsion and flap modes and edgewise and flap modes) and the influence of this coupling in terms of forced vibration, as well as aeroelastic stability, could be significant.

Vibratory strain distributions at speed are quite different from those at rest indicating the need to calculate mode shapes at speed accurately so that reliable calculations may be made to determine the susceptibility of the rotor to aeroelastic instabilities. It should be noted that strains, not displacements, were measured in this program and therefore, it would be necessary to calculate displacements from the strain surface and/or measure

the displacement field directly. As the blade displacements constitute an important input into any aeroelastic stability calculations, it would be desirable to have a data base of displacements for the purpose of direct calibrations of structural dynamic analyses.

It was found that the frequencies of the two blades were slightly different from each other. Therefore, one blade could be excited at its resonant frequency while the other is slightly off resonance. This tends to make excitation of rotor modes difficult. Studies need to be undertaken in regard to determine whether the aeroelastic stability of a rotor could be improved by deliberately mistuning the blades.

The quality of data taken in this program is somewhat influenced by the presence of an extraneous one-per-rev excitation that could not be eliminated since it would have required complete disassembly of the rig.

It was shown that all modes of interest of the rotor could be excited through the piezoelectric crystal excitation system and therefore the system represents a reliable and accurate method of inducing vibrations of similar components in an experimental program.

Tension axis tests at speed have confirmed that the modulus-weighted centroid for the nonhomogeneous airfoil is slightly off the mass centroid and validate the static method of determining the tension axis location described in Reference 2.

APPENDIX A

DATA REDUCTION PROCEDURES

The reduction procedures for the vibratory strain response data from the model rotor tests in the vacuum spin rig test facility are presented in this appendix. The strain response data were recorded in digital form on four separate magnetic tapes by the ATLAS data acquisition system. These data contain twelve different rotor configurations derived from two different pitch flexures and various pitch, droop, and precone angles. For each configuration, the rotor speed was varied between 0 and 1000 RPM. and at each rotor speed, the two blades (designated as blade number 8 and 5), were excited at each of their first five natural frequencies by piezoelectric crystals. Detailed parameters for the configuration, the rotor speeds, the fundamental modes, the record numbers, and the tape numbers are summarized in Table 5.

The strain responses at various points on the blade surfaces were recorded by twenty-one (21) strain gages. These strain gages are grouped into three different sets as shown in Table 3. The bridge configurations and conversion factors for each strain gage output from voltage to micro-strain are also presented on the same table. It was found that a total of approximately 4,000 strain response signals needed to be processed.

The data for each multiplexed set (or 'mux') were taken at three different instances in time and common reference channels were established in order to correlate these data. The amplitude and phase angle from one of the three common channels (or common gages) were used as normalizing factors in the presentation of mode shape results.

In the sections which follow, the four steps involved in this strain data reduction are presented. They are: (1) modification of existing UTRC modal analysis computer programs (2) preparation of the run-point specification input files (3) evaluation of the frequency and damping results for all cases, and (4) compilation of the mode shape results for all cases.

Modification of Modal Analysis Computer Programs

The existing UTRC modal analysis computer programs were updated for extracting the modal parameters from the strain gage responses described above. Figure 18 depicts the program logic established for this analysis.

The strain response data were sequentially recorded on magnetic tape. In order to retrieve and process a specific record from these tapes, the computer first reads a set of the run-point specifications from a input data file. Detailed discussions of this input data file are given in the next Section. In this input data file, if the run number (which is also called record number in this report) is zero, the program goes back to read another set of the run-point specifications. If the run number is less than zero, the program stops. This setup provides a high degree of flexibility in executing the program using the same input data file. If the run number is greater than zero, the computer searches for the same run number from the magnetic tape. If the run number on the tape matches that given in the input data file, then the two modal analysis programs are called in to perform the modal parameter estimates. The algorithms of these two modal analysis programs are described in Figures 19 and 20, respectively.

Due to a large number of time histories involved in this study, two different techniques were used for different purposes. The first one, which is based on the complex, exponential, modal curve fitting algorithm (Figure 19) is used for processing the data of the reference channel only. The second technique uses the FFT frequency spectrum interpolation formula (Figure 20) and is applied to all channels except the reference channel.

In Figure 19, the $x(t_j)$ represents the time histories to be analyzed, and curve-fitted by an analytical formula represented by $Y(t_j)$. The data point index j varies from 1 to N (number of points). $Y(t_j)$ is essentially a summation of several damped harmonic wave forms containing four parameters for each mode. These parameters are the damping value (ξ_m) the frequency ($2\pi f_m$), the sine and cosine coefficients (A_m, B_m), where m is the mode index varying from 1 to NM (number of modes). The analytical values for $Y(t_j)$ are obtained through a least squares curve fit between $Y(t_j)$ and $X(t_j)$ for all data points.

When the FFT program is executed, an amplitude plot will be obtained as shown in Figure 20, and a phase angle plot (not shown). The frequency resolution of the FFT spectrum will depend on the sampling rate (f_s) and the number of data points used in the FFT analysis. The true frequency (f), true amplitude (A), and true phase(ϕ) may be located between any two frequency bins f_u and f_{u+1}. The formulas used to compute these true modal parameters for the boxcar window are presented in the same figure.

The time domain modal curve fitting (MCF) has proven to be a very reliable and efficient way of extracting the modal frequency, damping value, amplitude and phase angle from a transient response signature.

Although the UTRC modal curve fitting program can fit up to four modes from any time histories, a bandpass filter was also used in conjunction with this MCF program to isolate only the principal mode of interest.

Because the damping value should be the same for all gages in the same mode, the MCF program is used only in processing the data of a reference channel. For the mode shape information, the FFT spectrum interpolation formulas shown in Figure 20 were used. These formulas have been used in many studies and have proved to be very efficient and reliable. By properly combining the MCF and FFT spectrum interpolation algorithms, it was estimated that a net saving of approximately 80 percent of computer CPU time was achieved.

Input Data Files of Run-point Specifications

In order to run the modal analysis computer program, an input data file for each configuration under consideration must be prepared. Figure 21 shows an example case of this input data file. In the input data file, the run number, the mux number, the plot option, the excitation frequency, the bandpass filter cutoff frequencies, the reference channel, the data length to be used for modal curve fitting, the time window function (for this study the boxcar window is used), and the channels to be processed are specified.

Execution of this computer program can be either in active mode (primarily for obtaining the time series and FFT plots) or batch mode by simply assigning a value of 0 to 1 or the IOPT parameter. IOPT = 2 is assigned if only the reference channel is of interest.

In assigning the bandpass filter cutoff frequencies, we have considered the excitation frequency, the data length, and the sampling rate used in obtaining the digital response data. These relationships are given in Table 41. The bandpass filter is used not only to isolate the principal mode for obtaining a filtered time series from the reference channel for modal curve fitting, but also is used for specifying the frequency range for FFT spectrum interpolations in the remaining channels.

It was found that some gages often have very high noise-to-signal ratios. Sometimes, there exists a very high peak near the principal mode in the FFT spectrum. In these cases, the bandpass filter assignment is not enough for rejecting the noise. It would require some additional specifications, such as the actual excitation frequency, or the number of the mode to be considered in the modal curve fitting program. These are provided through the input parameters of "HURZ" and "NM".

If a data array contains zero values throughout the entire time history, the program will print out a message and skip that channel. If the FFT spectrum contains no apparent peaks inside the bandpass filter, the program will print a different message and also bypass that channel. In either case, the amplitude and phase in the mode shape table are replaced by zero values. If the amplitude and phase for the reference channel are zero (either no signature or no apparent mode within the bandpass filter), the program will search for a maximum amplitude in the mode shape table and perform modal curve fitting on that channel to obtain the damping value estimate.

Evaluation of Frequency and Damping Results

The UTRC modal analysis computer programs can provide graphic outputs (Figures 22 to 24) as well as tabulated results (Figures 25 to 27). In the early stage of this data reduction, efforts were concentrated on checking the calibration constants used in the data acquisition system, and those recorded on the tape for the baseline case (Case 2 of Table 5). The plot option was turned on to obtain all plots for the time series, FFT spectrum, the input signals and results from the curve fitting program.

The frequency and damping estimates for the baseline case were carefully evaluated through cross examinations of the signature and the FFT plots (Fig. 22), and the inputs and results of the curve fitting (Fig. 23), and the ATLAS tape dump(Fig. 25). Some minor errors were discovered in the ATLAS data acquisition system software, but they were corrected through the data processing programs later.

Figure 22 shows a typical strain response time history and its FFT spectrum from channel 1 of record 588. The test condition, the date, the rotor configuration, and the sampling rate used in obtaining the digital data are clearly indicated. This represents one of the better signals available for analysis. It was found that the small peak appearing at 20 Hz on FFT plot had caused some disturbances in the time series plot. However, when the bandpass filter is applied, the filtered time history, shown in the upper frame of Figure 23 became much smoother. The lower frame of the same figure shows the curve fitted results, which agree very well with the inputs. Figure 24 shows the strain response from channel 5 of the same record. It can be seen that this signature contains a substantial amount of noise. The modal analysis algorithms described above were able to extract the modal information without any difficulty.

In addition to the above output, the program also provides three more outputs as shown in Figures 26 to 28. Figure 26 gives detailed lists of the modal curve fit and the FFT spectrum interpolation results. In the modal curve fitting, the frequency, damping, amplitude, and phase angle were estimated simultaneously. In the FFT spectrum interpolation, only the frequency, amplitude and phase angle were estimated. At the end, a summary of the modal analysis for that particular record (run) is printed.

Compilation of Mode Shape Results

As mentioned earlier, a total of 21 gages were used for obtaining the strain responses for the two blades. These gages were grouped into three separated sets. Figure 27 shows how the results are correlated for obtaining the mode shape information. Because only the channel number can be specified in the input data file instead of the gage number, special care was made to separate those gages from blade S/N 8 and blade S/N 5 in the third set. After that, the amplitude and phase angle of the reference gage in each mux were used as references for obtaining the normalized mode shapes. The frequency and damping values listed in Figure 27 are the averaged values obtained from the three separate records for a reference gage on blade S/N 8. For blade S/N 5, the damping value was not calculated and only the frequency value is tabulated.

An output data tape was also prepared, which contains the processed results as shown in Figure 28. The tape is written in ASCII format and has a block size of 80 bytes.

The data are organized in accordance with the run number. For each run record, there are two groups of data. Group-1 occupies only one data block and contains the data for the record number, the mux number, the number of channels to be included in Group-2, the frequency (Hz), the phase angle (degree), the normalizing amplitude (micro-strain), and the reference phase (degree) in that order. These data are written in a FORTRAN format of (3(1X,I4), 4(1X, E14.8)).

Group-2 will occupy several data blocks depending on the signal condition for each channel in the same record. The parameters presented in this group are the channel number (not the gage number), the normalized amplitude, and the corrected phase angle with respect to that of the reference channel. These are written in a FORTRAN format of (2X, I4, 2(2X, E14.8)).

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TABLE 1 ROTOR SPANWISE DISTRIBUTION OF MASS PROPERTIES AND STIFFNESS

Blade Station (in)	Weight lb/in	EI lb-in 10^6	EI lb-in 10^6	GK lb-in 10^6	I lb-in $\mu\epsilon$/in 10^6
.701	.292	20.0	20.0	19.6	
.725	.292	.161	.199	.000327	
.813	.292	.161	.199	.000327	
.813	.0115	.161	.199	.000327	
1.415	.0115	.161	.199	.000327	
1.415	.303	.161	.199	.000327	
1.539	.303	.161	.199	.000327	.543
1.539	.560	.161	.199	.000327	.543
1.626	.560	.161	.199	.000327	.543
1.651	.560	21.9	21.9	19.6	.543
1.665	.560	21.9	21.9	19.6	.543
1.665	.713	21.9	21.9	19.6	.543
1.726	.713	21.9	21.9	19.6	.543
1.726	.558	27.2	27.2	19.8	.494
2.101	.558	27.2	27.2	19.8	.494
2.101	.295	18.2	18.2	7.28	.165
2.301	.295	18.2	18.2	7.28	.165
2.301	.149	.300	30.3	1.80	.213
2.401	.149	.300	30.3	1.80	.213
2.401	.136	.242	21.8	1.66	.213
3.601	.136	.242	21.8	1.66	.213
3.601	.0193	.00589	.120	.00177	.0179
37.851	.0193	.00589	.120	.00177	.0179

TABLE 2 CALCULATED BLADE NATURAL FREQUENCIES (Uncoupled Modes)

		Frequency Hz.				
Flex	Speed RPM	Mode: 1st Flap	2nd Flap	3rd Flap	1st Edge	1st Tor.
Stiff	150	5.92	32.61	89.38	22.44	38.93
Soft	150	5.90	32.51	88.99	21.76	32.03
Stiff	400	9.23	36.62	93.62	22.69	40.77
Soft	400	9.21	36.51	93.22	21.99	33.90
Stiff	600	12.50	41.77	99.44	23.05	43.33
Soft	600	12.48	41.66	99.03	22.33	35.97
Stiff	800	15.92	48.04	106.99	23.54	46.09
Soft	800	15.90	47.91	106.55	22.78	38.22
Stiff	900	17.66	51.46	111.29	23.33	47.51
Soft	900	17.63	51.32	110.84	23.04	39.39
Stiff	1000	19.40	55.01	115.89	24.15	48.98
Soft	1000	19.36	54.87	115.42	23.33	40.57

TABLE 3 STRAIN GAGE CHANNEL ALLOCATION AND CONVERSION FACTORS

Mux No.	Channel No.	Gage No.	Blade No.	Bridge Configuration	Factor for $\mu\epsilon$
1	1	1	8	1/2	-321
1	2	2	8	1/2	-321
1	3	3	8	1/2	-321
1	4	4	8	1/2	-321
1	5	5	8	1/4	+642
1	6	6	8	1/4	+642
1	7	7	8	1/4	+642
1	8	8	8	1/4	-642
1	9	9	8	1/4	+642
1	10	10	8	1/4	+642
2	1	1	8	1/2	-321
2	2	11	8	1/4	+642
2	3	13	8	1/4	+642
2	4	14	8	1/4	+642
2	5	5	8	1/4	+642
2	6	15	8	1/4	+642
2	7	16	8	1/4	+642
2	8	--	8	1/4	+642
2	9	9	8	1/4	+642
2	10	12	8	1/4	+642
3	1	1	8	1/2	-321
3	2	--	--	1/4	+642
3	3	5	5	1/4	+642
3	4	8	5	1/4	+642
3	5	5	8	1/4	+642
3	6	9	5	1/4	+642
3	7	10	5	1/4	+642
3	8	--	--	1/4	+642
3	9	9	8	1/4	+642
3	10	1	5	1/2	+321

Parameters assumed constant for each module or gage:
gage factor = 2.1, excitation voltage = 6.9, module gain = 430

TABLE 4   FM TAPE RECORDER SET-UP

Channel	Input Volts pk-pk	Output Volts pk-pk	Band Width Hz	Paramater Assignment	Blade Mode
1	4.0	1.414	5	BL5 GA1 ARES CH1	Flap
2	3.5	1.414	5	BL5 GA2 ARES CH2	Edgewise
3	2.0	1.414	5	BL5 GA3 ARES CH3	Torsion
4	3.5	1.414	5	BL5 GA4 ARES CH4	Edge O/B
5	8.0	1.414	5	BL8 GA1 ATLAS CH1	Flap
6	7.0	1.414	5		
7	4.0	1.414	5		
8	7.0	1.414	5		
9	5.0	1.414	5	One per Rev.	
10	5.0	1.414	5	Transient Pulse	
11	1.414	1.414	5	Cal Signal 1 kHz	
12		1.414	5		
13		1.414	5		
14	Voice	1.414	5	Voice	

TABLE 5 TEST CONFIGURATIONS AND MODES ANALYZED

ITR Case	Flex	Configuration Pitch	Precone	Droop	Rotor RPM	Modes Analyzed	Record No.	Tape No.
1(a)	Stiff	0	0	0	0	1F,2F,3F,1E,1T	7-112	2
					400	1F,3F,1E,1T	202-216	2
					600	1F,2F,3F,1E,1T	218-233	2
					800		235-251	2
					1000		254-272	2
1(b)	Stiff	12	0	0	1000		301-316	3
					680	1F,2F,3F,1E,1T	317-334	3
5(a)	Stiff	0	0	-5	0		401-418	3
					1000		419-439	3
5(b)	Stiff	12	0	-5	1000		440-459	3
					0	1F,2F,3F,1E,1T	464-478	3
6(a)	Soft	0	0	-5	0	1F,2F,3F,1E,1T	479-496	3
					410	1F,1E	521-526	3
					710	1F,2F,1E	512-520	3
					1012	1F,2F,3F,1E,1T	497-511	3
6(b)	Soft	12	0	-5	0	2F,3F,1E,1T	527-541	4
					1000	1F,2F,3F,1E,1T	542-559	4
6(c)	Soft	-12	0	-5	0		558-572	4
					1000		573-587	4
2	Soft	0	0	0	0	1F,2F,3F,1E,1T	588-607	4
					775	1F,2F,1E,1T	626-637	4
					1000	1F,2F,3F,1E,1T	608-625	4
4(a)	Soft	0	5	0	0	1F,2F,3F,1E,1T	638-652	5
					1000		653-668	5
4(b)	Soft	12	5	0	0		670-686	5
					920			5
					-1000		687-703	
3(a)	Stiff	0	5	0	0		704-720	5
					1000		721-735	5
3(b)	Stiff	12	5	0	0		751-768	5
					1000	2F,3F,1E,1T	736-750	5

TABLE 6 POST TEST STRAIN GAGE STATIC CALIBRATION

STRAIN GAGE SENSITIVITY

Gage/Loading	Flap $\mu\epsilon$/lb Tip Up	Lead/Lag $\mu\epsilon$/ft.lb L/E Forward	Torsion $\mu\epsilon$/ft.lb L/E Up	L/E Down
1	1304	-8	-87	20
2	1023	-4	-105	2
3	698	1	- 66	- 11
4	381	1	-101	- 151
5	201	201	-109	- 140
6	89	160	- 48	- 127
7	92	140	35	22
8	-1124	43	319	205
9	- 480	35	1498	1725
10	135	- 15	9	13
11	- 752	22	131	105
12	- 329	118	1795	1616
13	132	- 9	22	92
14	- 219	6	57	61
15	- 88	- 7	1169	1655
16	41	- 2	44	44

TABLE 7 MODAL PARAMETERS FOR CONFIGURATION 1(a) AT 0 RPM

MODE= 1F, RPM= 0, FREQUENCY= 5.21 HZ (BLADE 8), 5.35 HZ (BLADE 5), DAMPING= 0.64 %

RECORD NO. 7 MUX 1 (BLD 8)			RECORD NO. 8 MUX 2 (BLD 8)			RECORD NO. 9 MUX 3 (BLD 8)			RECORD NO. 9 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.727	0.0	11	0.481	0.0	-	0.000	0.0	-	0.000	0.0
3	0.000	0.0	13	0.000	0.0	-	0.000	0.0	5	0.000	0.0
4	0.231	0.0	14	0.000	0.0	-	0.000	0.0	8	1.013	0.0
5	0.003	0.0	5	0.140	180.0	5	0.000	0.0	-	0.000	0.0
6	0.042	180.0	15	0.029	0.0	-	0.000	0.0	9	0.000	0.0
7	0.042	180.0	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
8	0.862	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.389	0.0	9	0.391	0.0	9	0.000	0.0	-	0.000	0.0
10	0.000	0.0	12	0.000	0.0	-	0.000	0.0	1	1.000	0.0
NF 1	36.904	125.3	1	36.708	108.9	1	35.265	113.0	1	8.882	293.0

MODE= 2F, RPM= 0, FREQUENCY= 32.37 HZ (BLADE 8), 33.00 HZ (BLADE 5), DAMPING= 0.63 %

RECORD NO. 1 MUX 1 (BLD 8)			RECORD NO. 2 MUX 2 (BLD 8)			RECORD NO. 3 MUX 3 (BLD 8)			RECORD NO. 3 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.115	0.0	11	0.585	180.0	-	0.000	0.0	-	0.000	0.0
3	0.872	180.0	13	0.000	0.0	-	0.000	0.0	5	0.000	0.0
4	0.638	180.0	14	0.000	0.0	-	0.000	0.0	8	1.034	0.0
5	0.003	0.0	5	0.209	180.0	5	0.000	0.0	-	0.000	0.0
6	0.000	0.0	15	0.176	180.0	-	0.000	0.0	9	0.000	0.0
7	0.049	180.0	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
8	0.823	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.000	0.0	9	0.301	0.0	9	0.000	0.0	-	0.000	0.0
10	0.000	0.0	12	0.000	0.0	-	0.000	0.0	1	1.000	0.0
NF 1	34.395	167.4	1	34.109	145.6	1	33.779	140.7	1	14.025	140.7

MODE= 3F, RPM= 0, FREQUENCY= 91.41 HZ (BLADE 8), 90.81 HZ (BLADE 5), DAMPING= 0.57 %

RECORD NO. 1 MUX 1 (BLD 8)			RECORD NO. 2 MUX 2 (BLD 8)			RECORD NO. 3 MUX 3 (BLD 8)			RECORD NO. 3 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.000	0.0	1	0.000	0.0	1	0.000	0.0	-	0.000	0.0
2	5.568	121.7	11	7.701	97.2	-	0.000	0.0	-	0.000	0.0
3	0.000	0.0	13	0.000	0.0	-	0.000	0.0	5	0.000	0.0
4	12.376	-55.1	14	0.000	0.0	-	0.000	0.0	8	1.050	0.0
5	0.000	0.0	5	1.013	109.2	5	0.000	0.0	-	0.000	0.0
6	0.391	180.0	15	4.042	-81.2	-	0.000	0.0	9	0.000	0.0
7	0.201	-42.2	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
8	8.669	-54.3	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.003	0.0	9	0.000	0.0	9	0.000	0.0	-	0.000	0.0
10	0.003	0.0	12	0.000	0.0	-	0.000	0.0	1	1.000	0.0
NF	1.000	0.0		1.000	0.0		1.000	0.0	1	15.573	-68.2

MODE= 1E, RPM= 0, FREQUENCY= 24.02 HZ (BLADE 8), 24.03 HZ (BLADE 5), DAMPING= 0.60 %

RECORD NO. 104 MUX 1 (BLD 8)			RECORD NO. 105 MUX 2 (BLD 8)			RECORD NO. 106 MUX 3 (BLD 8)			RECORD NO. 106 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.003	0.0	1	0.000	0.0	1	0.000	0.0	-	0.000	0.0
2	0.046	-124.5	11	1.835	-43.5	-	0.000	0.0	-	0.000	0.0
3	0.003	0.0	13	0.000	0.0	-	0.000	0.0	5	10.676	0.0
4	0.343	139.3	14	0.000	0.0	-	0.000	0.0	8	1.637	0.0
5	0.003	0.0	5	24.707	-43.0	5	24.451	-36.4	-	0.000	0.0
6	16.370	-42.6	15	0.580	140.1	-	0.000	0.0	9	1.000	0.0
7	13.022	-42.2	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
8	0.000	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.003	0.0	9	0.000	0.0	9	0.000	0.0	-	0.000	0.0
10	0.003	0.0	12	0.000	0.0	-	0.000	0.0	1	0.298	180.0
NF	1.003	0.0		1.000	0.0		1.000	0.0	5	1.797	144.4

MODE= 1T, RPM= 0, FREQUENCY= 43.61 HZ (BLADE 8), 43.49 HZ (BLADE 5), DAMPING= 0.85 %

RECORD NO. 110 MUX 1 (BLD 8)			RECORD NO. 111 MUX 2 (BLD 8)			RECORD NO. 112 MUX 3 (BLD 8)			RECORD NO. 112 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.000	0.0	1	0.000	0.0	1	0.000	0.0	-	0.000	0.0
2	0.003	0.0	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.003	0.0	13	0.000	0.0	-	0.000	0.0	5	2.547	0.0
4	0.003	0.0	14	0.000	0.0	-	0.000	0.0	8	0.481	0.0
5	0.003	0.0	5	0.319	-98.5	5	0.318	-98.4	-	0.000	0.0
6	0.302	-95.4	15	0.304	0.0	-	0.000	0.0	9	1.000	0.0
7	0.310	0.0	16	0.000	0.0	-	0.000	0.0	10	0.258	180.0
8	0.262	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	1.003	0.0	9	1.000	0.0	9	1.000	0.0	-	0.000	0.0
10	0.003	0.0	12	0.954	0.0	-	0.000	0.0	1	0.000	0.0
NF 9	31.985	-59.6	9	31.950	-57.6	9	32.758	-123.4	9	6.289	-123.4

TABLE 8 MODAL PARAMETERS FOR CONFIGURATION 1(a) AT 400 RPM

MODE= 1F, RPM= 400, FREQUENCY= 9.53 HZ (BLADE 8), 9.64 HZ (BLADE 5), DAMPING= 0.22 %

RECORD NO. 202 MUX 1 (BLD 8)			RECORD NO. 203 MUX 2 (BLD 8)			RECORD NO. 204 MUX 3 (BLD 8)			RECORD NO. 204 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.574	0.0	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.218	0.0	13	0.046	180.0	-	0.000	0.0	5	0.180	0.0
4	0.075	-11.5	14	0.000	0.0	-	0.000	0.0	8	1.035	0.0
5	0.137	180.0	5	0.134	180.0	5	0.137	180.0	-	0.000	0.0
6	0.041	128.2	15	0.026	109.3	-	0.000	0.0	9	0.165	0.0
7	0.046	74.5	16	0.000	0.0	-	0.000	0.0	10	0.220	180.0
8	0.865	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.409	0.0	9	0.000	0.0	9	0.399	0.0	-	0.000	0.0
10	0.086	180.0	12	0.144	0.0	-	0.000	0.0	1	1.000	0.0
NF 1	11.869	-65.9	1	8.925	14.4	1	12.822	-171.5	1	8.746	8.5

MODE= 2F, RPM= 400, FREQUENCY= 36.69 HZ (BLADE 8), 32.30 HZ (BLADE 5), DAMPING= 1.39 %

RECORD NO. 205 MUX 1 (BLD 8)			RECORD NO. 206 MUX 2 (BLD 8)			RECORD NO. 207 MUX 3 (BLD 8)			RECORD NO. 207 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.088	0.0	11	0.563	180.0	-	0.000	0.0	-	0.000	0.0
3	0.862	180.0	13	0.088	0.0	-	0.000	0.0	5	3.343	180.0
4	0.215	180.0	14	0.323	180.0	-	0.000	0.0	8	1.080	180.0
5	1.326	0.0	5	1.064	-40.1	5	3.446	180.0	-	0.000	0.0
6	0.658	-18.6	15	0.210	180.0	-	0.000	0.0	9	1.073	180.0
7	0.483	-18.8	16	0.049	0.0	-	0.000	0.0	10	0.180	63.8
8	0.003	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.827	180.0	9	0.238	0.0	9	0.687	180.0	-	0.000	0.0
10	0.245	0.0	12	0.394	180.0	-	0.000	0.0	1	0.000	0.0
NF 1	24.943	159.9	1	27.328	-171.5	1	1.178	21.9		1.000	0.0

MODE= 3F, RPM= 400, FREQUENCY= 95.89 HZ (BLADE 8), 96.13 HZ (BLADE 5), DAMPING= 0.58 %

RECORD NO. 208 MUX 1 (BLD 8)			RECORD NO. 209 MUX 2 (BLD 8)			RECORD NO. 210 MUX 3 (BLD 8)			RECORD NO. 210 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.561	180.0	11	0.834	180.0	-	0.000	0.0	-	0.000	0.0
3	0.139	180.0	13	0.181	0.0	-	0.000	0.0	5	5.589	20.8
4	1.246	0.0	14	0.830	0.0	-	0.000	0.0	8	28.897	-139.4
5	0.093	157.7	5	0.109	180.0	5	0.150	100.7	-	0.000	0.0
6	0.146	41.8	15	0.461	0.0	-	0.000	0.0	9	5.672	-135.1
7	0.128	139.4	16	0.150	180.0	-	0.000	0.0	10	6.778	40.5
8	0.832	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.000	0.0	9	0.000	0.0	9	0.302	0.0	-	0.000	0.0
10	0.120	180.0	12	0.373	180.0	-	0.000	0.0	1	0.000	0.0
NF 1	18.177	-137.6	1	17.591	-109.9	1	18.305	-118.5		1.000	0.0

MODE= 1E, RPM= 400, FREQUENCY= 24.30 HZ (BLADE 8), 24.35 HZ (BLADE 5), DAMPING= 0.61 %

RECORD NO. 211 MUX 1 (BLD 8)			RECORD NO. 212 MUX 2 (BLD 8)			RECORD NO. 213 MUX 3 (BLD 8)			RECORD NO. 213 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.000	0.0	1	0.000	0.0	1	0.000	0.0	-	0.000	0.0
2	0.000	0.0	11	0.075	0.0	-	0.000	0.0	-	0.000	0.0
3	0.049	49.1	13	0.036	180.0	-	0.000	0.0	5	1.000	0.0
4	0.027	43.7	14	0.000	0.0	-	0.000	0.0	8	0.135	180.0
5	1.000	0.0	5	1.000	0.0	5	1.000	0.0	-	0.000	0.0
6	0.685	0.0	15	0.025	180.0	-	0.000	0.0	9	0.000	0.0
7	0.543	0.0	16	0.023	51.5	-	0.000	0.0	10	0.078	180.0
8	0.182	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.054	-90.9	9	0.041	180.0	9	0.057	180.0	-	0.000	0.0
10	0.071	138.0	12	0.024	48.7	-	0.000	0.0	1	0.000	0.0
NF 5	17.508	-22.1	5	29.245	-81.8	5	21.394	-44.7	5	15.938	130.3

MODE= 1T, RPM= 400, FREQUENCY= 45.00 HZ (BLADE 8), 47.59 HZ (BLADE 5), DAMPING= 0.57 %

RECORD NO. 216 MUX 1 (BLD 8)			RECORD NO. 215 MUX 2 (BLD 8)			RECORD NO. 214 MUX 3 (BLD 8)			RECORD NO. 214 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.095	180.0	1	0.127	180.0	1	0.096	-72.5	-	0.000	0.0
2	0.030	180.0	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.062	154.1	13	0.100	180.0	-	0.000	0.0	5	10.405	-81.0
4	0.064	40.6	14	0.000	0.0	-	0.000	0.0	8	2.224	-102.2
5	2.576	20.5	5	2.849	33.5	5	2.505	103.3	-	0.000	0.0
6	1.903	20.4	15	0.340	92.8	-	0.000	0.0	9	1.000	0.0
7	1.592	20.3	16	0.031	127.0	-	0.000	0.0	10	0.852	180.0
8	0.409	21.3	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	1.000	0.0	9	1.000	0.0	9	1.000	0.0	-	0.000	0.0
10	0.213	180.0	12	0.992	0.0	-	0.000	0.0	1	0.000	0.0
NF 9	9.840	-75.8	9	9.737	-103.5	9	10.220	-3.7	9	1.821	176.3

TABLE 9 MODAL PARAMETERS FOR CONFIGURATION 1(a) AT 600 RPM

MODE= 1F, RPM= 600, FREQUENCY= 12.75 HZ (BLADE 8), 12.84 HZ (BLADE 5), DAMPING= 0.14 %

RECORD NO. 218 MUX 1 (BLD 8)			RECORD NO. 219 MUX 2 (BLD 8)			RECORD NO. 220 MUX 3 (BLD 8)			RECORD NO. 220 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.469	0.0	11	0.273	-28.3	-	0.000	0.0	-	0.000	0.0
3	0.139	0.0	13	0.046	180.0	-	0.000	0.0	5	0.226	84.6
4	0.056	0.0	14	0.000	0.0	-	0.000	0.0	8	1.054	0.0
5	0.109	180.0	5	0.109	-140.7	5	0.071	180.0	-	0.000	0.0
6	0.024	-74.6	15	0.000	0.0	-	0.000	0.0	9	0.183	0.0
7	0.003	0.0	16	0.000	0.0	-	0.000	0.0	10	0.234	180.0
8	0.869	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.003	0.0	9	0.532	180.0	9	0.402	0.0	-	0.000	0.0
10	0.097	180.0	12	0.000	0.0	-	0.000	0.0	1	1.000	0.0
NF 1	25.221	-176.6	1	29.721	131.2	1	16.094	-131.0	1	5.930	-131.0

MODE= 2F, RPM= 600, FREQUENCY= 42.37 HZ (BLADE 8), 42.69 HZ (BLADE 5), DAMPING= 0.53 %

RECORD NO. 221 MUX 1 (BLD 8)			RECORD NO. 222 MUX 2 (BLD 8)			RECORD NO. 223 MUX 3 (BLD 8)			RECORD NO. 223 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.003	0.0	11	0.206	-162.5	-	0.000	0.0	-	0.000	0.0
3	0.837	180.0	13	0.000	0.0	-	0.000	0.0	5	10.682	-96.7
4	0.686	180.0	14	0.349	180.0	-	0.000	0.0	8	1.765	-96.7
5	3.749	-52.1	5	6.696	-46.4	5	6.193	0.0	-	0.000	0.0
6	2.583	-50.2	15	0.327	180.0	-	0.000	0.0	9	0.186	-156.3
7	2.115	-49.9	16	0.000	0.0	-	0.000	0.0	10	0.837	83.3
8	0.000	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.273	-87.9	9	0.468	-55.7	9	0.415	-81.7	-	0.000	0.0
10	0.320	180.0	12	0.000	0.0	-	0.000	0.0	1	1.000	0.0
NF 1	25.642	169.3	1	14.083	-170.2	1	15.879	110.5	1	8.837	207.2

MODE= 3F, RPM= 600, FREQUENCY=101.95 HZ (BLADE 8), 101.34 HZ (BLADE 5), DAMPING= 0.54 %

RECORD NO. 224 MUX 1 (BLD 8)			RECORD NO. 225 MUX 2 (BLD 8)			RECORD NO. 227 MUX 3 (BLD 8)			RECORD NO. 227 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.565	180.0	11	0.832	180.0	-	0.000	0.0	-	0.000	0.0
3	0.162	180.0	13	0.192	0.0	-	0.000	0.0	5	0.283	132.5
4	1.279	0.0	14	0.868	0.0	-	0.000	0.0	8	1.092	0.0
5	0.142	-52.4	5	0.155	-56.7	5	0.173	-50.8	-	0.000	0.0
6	0.199	79.0	15	0.486	0.0	-	0.000	0.0	9	0.175	-85.0
7	0.232	103.9	16	0.164	180.0	-	0.000	0.0	10	0.250	132.5
8	0.824	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.276	0.0	9	0.281	0.0	9	0.269	11.8	-	0.000	0.0
10	0.121	180.0	12	0.378	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	21.446	-75.8	1	13.709	-16.7	1	12.384	-18.8	1	10.671	28.7

MODE= 1E, RPM= 650, FREQUENCY= 24.50 HZ (BLADE 8), 24.46 HZ (BLADE 5), DAMPING= 0.70 %

RECORD NO. 228 MUX 1 (BLD 8)			RECORD NO. 229 MUX 2 (BLD 8)			RECORD NO. 230 MUX 3 (BLD 8)			RECORD NO. 230 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.039	-119.5	1	0.039	-136.3	1	0.033	130.6	-	0.000	0.0
2	0.028	-139.6	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.000	0.0	13	0.035	-166.3	-	0.000	0.0	5	1.000	0.0
4	0.000	0.0	14	0.000	0.0	-	0.000	0.0	8	0.061	0.0
5	1.000	0.0	5	1.000	0.0	5	1.000	0.0	-	0.000	0.0
6	0.633	0.0	15	0.027	180.0	-	0.000	0.0	9	0.000	0.0
7	0.625	20.4	16	0.000	0.0	-	0.000	0.0	10	0.079	-168.4
8	0.219	20.8	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.000	0.0	9	0.024	180.0	9	0.000	0.0	-	0.000	0.0
10	0.090	180.0	12	0.028	180.0	-	0.000	0.0	1	0.037	0.0
NF 5	82.370	-51.4	5	69.935	-76.4	5	71.509	-107.8	5	56.940	72.2

MODE= 1T, RPM= 650, FREQUENCY= 44.31 HZ (BLADE 8), 44.43 HZ (BLADE 5), DAMPING=-0.18 %

RECORD NO. 231 MUX 1 (BLD 8)			RECORD NO. 232 MUX 2 (BLD 8)			RECORD NO. 233 MUX 3 (BLD 8)			RECORD NO. 233 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.136	180.0	1	1.103	113.7	1	0.920	180.0	-	0.000	0.0
2	0.078	145.9	11	0.578	-22.6	-	0.000	0.0	-	0.000	0.0
3	0.896	0.0	13	0.100	180.0	-	0.000	0.0	5	20.809	180.0
4	0.756	0.0	14	0.000	0.0	-	0.000	0.0	8	41.960	180.0
5	3.149	14.2	5	3.522	66.9	5	3.788	0.0	-	0.000	0.0
6	2.263	14.0	15	0.592	-48.7	-	0.000	0.0	9	1.000	0.0
7	1.897	13.8	16	0.038	180.0	-	0.000	0.0	10	10.287	0.0
8	0.737	104.5	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	1.003	0.0	9	1.000	0.0	9	1.000	0.0	-	0.000	0.0
10	0.240	180.0	12	1.464	-38.5	-	0.000	0.0	1	34.892	-169.9
NF 9	7.490	-55.5	9	8.792	-96.4	9	6.751	147.4	9	0.814	327.4

TABLE 10 MODAL PARAMETERS FOR CONFIGURATION 1(a) AT 800 RPM

MODE= 1F, RPM= 800, FREQUENCY= 16.30 HZ (BLADE 8), 16.45 HZ (BLADE 5), DAMPING= 0.23 %

RECORD NO. 235 MUX 1 (BLD 8)			RECORD NO. 236 MUX 2 (BLD 8)			RECORD NO. 237 MUX 3 (BLD 8)			RECORD NO. 237 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.375	0.0	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.091	0.0	13	0.000	0.0	-	0.000	0.0	5	0.273	-146.9
4	0.037	0.0	14	0.000	0.0	-	0.000	0.0	8	1.063	0.0
5	0.198	-102.5	5	0.355	-41.5	5	0.384	98.1	-	0.000	0.0
6	0.108	-100.5	15	0.000	0.0	-	0.000	0.0	9	0.180	0.0
7	0.977	-99.6	16	0.028	180.0	-	0.000	0.0	10	0.241	180.0
8	0.872	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.410	0.0	9	0.412	0.0	9	0.411	0.0	-	0.000	0.0
10	0.103	180.0	12	0.070	0.0	-	0.000	0.0	1	1.000	0.0
NF 1	36.895	97.1	1	22.992	118.6	1	20.984	-42.5	1	25.409	17.7

MODE= 2F, RPM= 800, FREQUENCY= 49.40 HZ (BLADE 8), 50.18 HZ (BLADE 5), DAMPING= 0.24 %

RECORD NO. 238 MUX 1 (BLD 8)			RECORD NO. 239 MUX 2 (BLD 8)			RECORD NO. 240 MUX 3 (BLD 8)			RECORD NO. 240 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.022	-13.5	11	0.535	180.0	-	0.000	0.0	-	0.000	0.0
3	0.833	180.0	13	0.146	43.8	-	0.000	0.0	5	0.411	11.9
4	0.723	180.0	14	0.000	0.0	-	0.000	0.0	8	1.015	0.0
5	0.387	-165.4	5	0.365	180.0	5	0.400	180.0	-	0.000	0.0
6	0.142	180.0	15	0.000	0.0	-	0.000	0.0	9	5.348	137.5
7	0.064	-132.3	16	0.095	39.5	-	0.000	0.0	10	0.580	-163.8
8	0.971	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	1.181	0.0	9	0.000	0.0	9	1.165	0.0	-	0.000	0.0
10	0.071	180.0	12	0.550	37.3	-	0.000	0.0	1	1.000	0.0
NF 1	11.827	140.1	1	7.967	-10.7	1	17.423	9.3	1	4.208	51.8

MODE= 3F, RPM= 800, FREQUENCY=109.30 HZ (BLADE 8), 108.89 HZ (BLADE 5), DAMPING= 0.44 %

RECORD NO. 241 MUX 1 (BLD 8)			RECORD NO. 244 MUX 2 (BLD 8)			RECORD NO. 245 MUX 3 (BLD 8)			RECORD NO. 245 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	5.084	101.2	11	0.815	180.0	-	0.000	0.0	-	0.000	0.0
3	0.000	0.0	13	0.205	0.0	-	0.000	0.0	5	0.380	-168.7
4	11.773	-79.2	14	0.935	0.0	-	0.000	0.0	8	1.082	0.0
5	1.211	86.5	5	0.155	105.9	5	0.143	148.9	-	0.000	0.0
6	0.745	133.3	15	0.557	0.0	-	0.000	0.0	9	0.000	0.0
7	1.233	138.9	16	0.212	180.0	-	0.000	0.0	10	0.213	180.0
8	6.922	-84.6	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.000	0.0	9	0.269	0.0	9	0.000	0.0	-	0.000	0.0
10	1.074	101.0	12	0.357	180.0	-	0.000	0.0	1	1.000	0.0
NF	1.000	0.0	1	14.744	158.2	1	14.994	-50.4	1	6.726	19.6

MODE= 1E, RPM= 800, FREQUENCY= 24.71 HZ (BLADE 8), 24.78 HZ (BLADE 5), DAMPING= 0.74 %

RECORD NO. 246 MUX 1 (BLD 8)			RECORD NO. 247 MUX 2 (BLD 8)			RECORD NO. 248 MUX 3 (BLD 8)			RECORD NO. 248 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.027	180.0	1	0.027	180.0	1	0.027	-29.9	-	0.000	0.0
2	0.000	0.0	11	0.074	0.0	-	0.000	0.0	-	0.000	0.0
3	0.000	0.0	13	0.034	180.0	-	0.000	0.0	5	1.000	0.0
4	0.000	0.0	14	0.000	0.0	-	0.000	0.0	8	0.132	-34.5
5	1.000	0.0	5	1.000	0.0	5	1.000	0.0	-	0.000	0.0
6	0.603	0.0	15	0.022	168.2	-	0.000	0.0	9	0.034	180.0
7	0.467	0.0	16	0.000	0.0	-	0.000	0.0	10	0.078	180.0
8	0.166	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.000	0.0	9	0.000	0.0	9	0.000	0.0	-	0.000	0.0
10	0.087	180.0	12	0.000	0.0	-	0.000	0.0	1	0.000	0.0
NF 5	87.222	-119.0	5	94.757	-101.2	5	98.720	-94.6	5	75.878	85.4

MODE= 1T, RPM= 800, FREQUENCY= 48.50 HZ (BLADE 8), 48.45 HZ (BLADE 5), DAMPING= 0.33 %

RECORD NO. 249 MUX 1 (BLD 8)			RECORD NO. 250 MUX 2 (BLD 8)			RECORD NO. 251 MUX 3 (BLD 8)			RECORD NO. 251 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.705	0.0	1	0.674	37.3	1	0.724	0.0	-	0.000	0.0
2	0.000	0.0	11	0.063	180.0	-	0.000	0.0	-	0.000	0.0
3	0.592	180.0	13	0.000	0.0	-	0.000	0.0	5	0.886	-29.0
4	0.508	180.0	14	0.268	-141.4	-	0.000	0.0	8	0.852	180.0
5	0.331	-138.0	5	0.364	-81.9	5	0.541	180.0	-	0.000	0.0
6	0.281	-130.9	15	0.165	0.0	-	0.000	0.0	9	1.000	0.0
7	0.241	-128.3	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
8	0.424	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	1.000	0.0	9	1.000	0.0	9	1.000	0.0	-	0.000	0.0
10	0.000	0.0	12	0.609	0.0	-	0.000	0.0	1	0.952	180.0
NF 9	42.067	68.2	9	37.573	103.1	9	26.306	-125.6	9	7.702	54.4

TABLE 11 MODAL PARAMETERS FOR CONFIGURATION 1(a) AT 1000 RPM

MODE= 1F, RPM= 1000, FREQUENCY= 19.52 HZ (BLADE 8), 19.59 HZ (BLADE 5), DAMPING= 0.10 %

RECORD NO. 254 MUX 1 (BLD 8)			RECORD NO. 255 MUX 2 (BLD 8)			RECORD NO. 256 MUX 3 (BLD 8)			RECORD NO. 256 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.308	0.0	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.065	0.0	13	0.027	156.8	-	0.000	0.0	5	0.324	180.0
4	0.000	0.0	14	0.000	0.0	-	0.000	0.0	8	1.096	0.0
5	0.115	180.0	5	0.000	0.0	5	0.138	180.0	-	0.000	0.0
6	0.078	-29.5	15	0.000	0.0	-	0.000	0.0	9	0.180	0.0
7	0.061	-23.5	16	0.000	0.0	-	0.000	0.0	10	0.256	180.0
8	0.845	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.398	0.0	9	0.516	-10.9	9	0.431	0.0	-	0.000	0.0
10	0.083	180.0	12	0.067	0.0	-	0.000	0.0	1	1.000	0.0
NF 1	81.028	135.1	1	61.002	-155.8	1	58.839	144.4	1	37.467	324.4

MODE= 2F, RPM= 1000, FREQUENCY= 55.93 HZ (BLADE 8), 55.98 HZ (BLADE 5), DAMPING=-0.01 %

RECORD NO. 257 MUX 1 (BLD 8)			RECORD NO. 258 MUX 2 (BLD 8)			RECORD NO. 259 MUX 3 (BLD 8)			RECORD NO. 259 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.000	0.0	11	0.509	180.0	-	0.000	0.0	-	0.000	0.0
3	0.786	180.0	13	0.118	0.0	-	0.000	0.0	5	0.368	-146.8
4	0.738	180.0	14	0.417	180.0	-	0.000	0.0	8	1.087	0.0
5	0.689	78.9	5	0.649	-114.2	5	0.597	-118.2	-	0.000	0.0
6	0.533	79.2	15	0.048	180.0	-	0.000	0.0	9	0.473	12.5
7	0.450	77.8	16	0.086	0.0	-	0.000	0.0	10	0.275	180.0
8	0.892	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.699	0.0	9	0.702	0.0	9	0.697	0.0	-	0.000	0.0
10	0.089	-169.3	12	0.088	31.0	-	0.000	0.0	1	1.000	0.0
NF 1	26.605	31.9	1	27.046	29.8	1	30.985	115.7	1	35.543	115.7

MODE= 3F, RPM= 1000, FREQUENCY=117.41 HZ (BLADE 8), 117.57 HZ (BLADE 5), DAMPING= 0.37 %

RECORD NO. 260 MUX 1 (BLD 8)			RECORD NO. 261 MUX 2 (BLD 8)			RECORD NO. 262 MUX 3 (BLD 8)			RECORD NO. 262 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.593	180.0	11	0.847	180.0	-	0.000	0.0	-	0.000	0.0
3	0.212	180.0	13	0.207	0.0	-	0.000	0.0	5	0.261	180.0
4	1.382	0.0	14	0.639	52.9	-	0.000	0.0	8	0.829	35.5
5	0.163	113.1	5	0.152	0.0	5	0.137	180.0	-	0.000	0.0
6	0.247	-53.4	15	0.658	0.0	-	0.000	0.0	9	0.269	17.7
7	0.284	-78.3	16	0.164	180.0	-	0.000	0.0	10	0.285	180.0
8	0.802	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.157	-19.7	9	0.046	38.2	9	0.178	0.0	-	0.000	0.0
10	0.141	180.0	12	0.274	-129.3	-	0.000	0.0	1	1.000	0.0
NF 1	24.451	-42.9	1	25.155	158.2	1	24.757	-156.9	1	22.358	-156.9

MODE= 1E, RPM= 1000, FREQUENCY= 25.09 HZ (BLADE 8), 25.16 HZ (BLADE 5), DAMPING= 0.89 %

RECORD NO. 266 MUX 1 (BLD 8)			RECORD NO. 267 MUX 2 (BLD 8)			RECORD NO. 269 MUX 3 (BLD 8)			RECORD NO. 269 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.000	0.0	1	0.000	0.0	1	0.000	0.0	-	0.000	0.0
2	0.000	0.0	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.000	0.0	13	0.031	180.0	-	0.000	0.0	5	1.000	0.0
4	0.000	0.0	14	0.000	0.0	-	0.000	0.0	8	0.171	0.0
5	1.000	0.0	5	1.000	0.0	5	1.000	0.0	-	0.000	0.0
6	0.581	0.0	15	0.000	0.0	-	0.000	0.0	9	0.056	180.0
7	0.446	0.0	16	0.000	0.0	-	0.000	0.0	10	0.077	180.0
8	0.159	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.002	0.0	9	0.000	0.0	9	0.000	0.0	-	0.000	0.0
10	0.086	180.0	12	0.000	0.0	-	0.000	0.0	1	0.000	0.0
NF 5	58.838	-84.5	5	64.074	-57.3	5	63.146	-105.4	5	48.204	74.6

MODE= 1T, RPM= 1000, FREQUENCY= 47.93 HZ (BLADE 8), 50.34 HZ (BLADE 5), DAMPING= 0.46 %

RECORD NO. 270 MUX 1 (BLD 8)			RECORD NO. 271 MUX 2 (BLD 8)			RECORD NO. 272 MUX 3 (BLD 8)			RECORD NO. 272 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.097	180.0	1	0.000	0.0	1	0.000	0.0	-	0.000	0.0
2	0.000	0.0	11	0.120	-74.7	-	0.000	0.0	-	0.000	0.0
3	0.000	0.0	13	0.045	-25.6	-	0.000	0.0	5	1.050	166.5
4	0.069	-20.0	14	0.000	0.0	-	0.000	0.0	8	0.294	180.0
5	0.949	124.4	5	0.945	-97.8	5	0.923	143.7	-	0.000	0.0
6	0.715	123.9	15	0.382	0.0	-	0.000	0.0	9	1.000	0.0
7	0.596	124.4	16	0.040	180.0	-	0.000	0.0	10	0.070	24.7
8	0.150	122.1	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	1.000	0.0	9	1.000	0.0	9	1.000	0.0	-	0.000	0.0
10	0.062	-17.0	12	1.053	0.0	-	0.000	0.0	1	0.136	-101.7
NF 9	35.089	25.9	9	31.543	4.5	9	34.354	23.7	9	12.484	-1.0

TABLE 12 MODAL PARAMETERS FOR CONFIGURATION 1(b) AT 680 RPM

MODE= 1F, RPM= 650, FREQUENCY= 13.52 HZ (BLADE 8), 13.51 HZ (BLADE 5), DAMPING= 0.12 %

RECORD NO. 317 MUX 1 (BLD 8)			RECORD NO. 318 MUX 2 (BLD 8)			RECORD NO. 319 MUX 3 (BLD 8)			RECORD NO. 319 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.449	0.0	11	0.184	0.0	-	0.000	0.0	-	0.000	0.0
3	0.133	0.0	13	0.028	180.0	-	0.000	0.0	5	0.215	180.0
4	0.051	0.0	14	0.000	0.0	-	0.000	0.0	8	1.045	0.0
5	0.280	180.0	5	0.281	180.0	5	0.276	180.0	-	0.000	0.0
6	0.088	180.0	15	0.000	0.0	-	0.000	0.0	9	0.176	0.0
7	0.065	180.0	16	0.000	0.0	-	0.000	0.0	10	0.232	180.0
8	0.842	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.406	0.0	9	0.405	0.0	9	0.405	0.0	-	0.000	0.0
10	0.083	180.0	12	0.101	0.0	-	0.000	0.0	1	1.000	0.0
NF 1	38.169	16.7	1	45.624	-2.1	1	35.030	38.9	1	50.467	38.9

MODE= 2F, RPM= 680, FREQUENCY= 43.86 HZ (BLADE 8), 44.18 HZ (BLADE 5), DAMPING= 0.48 %

RECORD NO. 320 MUX 1 (BLD 8)			RECORD NO. 321 MUX 2 (BLD 8)			RECORD NO. 322 MUX 3 (BLD 8)			RECORD NO. 322 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.042	0.0	11	0.409	180.0	-	0.000	0.0	-	0.000	0.0
3	0.830	180.0	13	0.055	-121.8	-	0.000	0.0	5	1.224	0.0
4	0.694	180.0	14	0.349	180.0	-	0.000	0.0	8	0.000	0.0
5	0.367	53.7	5	0.397	-68.7	5	0.000	0.0	-	0.000	0.0
6	0.219	44.9	15	0.526	180.0	-	0.000	0.0	9	0.179	180.0
7	0.162	50.1	16	0.041	180.0	-	0.000	0.0	10	0.263	180.0
8	0.683	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.504	180.0	9	0.678	180.0	9	0.526	180.0	-	0.000	0.0
10	0.127	180.0	12	1.273	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	27.476	70.8	1	31.358	143.0	1	29.744	138.7	1	12.998	318.7

MODE= 3F, RPM= 680, FREQUENCY=104.08 HZ (BLADE 8), 104.14 HZ (BLADE 5), DAMPING= 0.39 %

RECORD NO. 323 MUX 1 (BLD 8)			RECORD NO. 324 MUX 2 (BLD 8)			RECORD NO. 325 MUX 3 (BLD 8)			RECORD NO. 325 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.578	180.0	11	0.823	180.0	-	0.000	0.0	-	0.000	0.0
3	0.166	180.0	13	0.176	0.0	-	0.000	0.0	5	0.198	157.5
4	1.307	0.0	14	0.905	0.0	-	0.000	0.0	8	1.097	0.0
5	0.073	180.0	5	0.080	-39.4	5	0.056	180.0	-	0.000	0.0
6	0.208	180.0	15	0.511	0.0	-	0.000	0.0	9	0.288	0.0
7	0.245	180.0	16	0.183	180.0	-	0.000	0.0	10	0.255	157.5
8	0.831	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.269	0.0	9	0.270	-12.9	9	0.304	14.3	-	0.000	0.0
10	0.122	180.0	12	0.352	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	24.257	118.0	1	27.637	-158.1	1	32.375	-82.4	1	31.307	-59.9

MODE= 1E, RPM= 680, FREQUENCY= 24.54 HZ (BLADE 8), 24.44 HZ (BLADE 5), DAMPING= 0.69 %

RECORD NO. 326 MUX 1 (BLD 8)			RECORD NO. 327 MUX 2 (BLD 8)			RECORD NO. 328 MUX 3 (BLD 8)			RECORD NO. 328 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.039	51.3	1	0.034	180.0	1	0.031	180.0	-	0.000	0.0
2	0.031	39.4	11	0.074	0.0	-	0.000	0.0	-	0.000	0.0
3	0.021	19.6	13	0.036	180.0	-	0.000	0.0	5	1.000	0.0
4	0.000	0.0	14	0.000	0.0	-	0.000	0.0	8	0.168	0.0
5	1.000	0.0	5	1.000	0.0	5	1.000	0.0	-	0.000	0.0
6	0.625	0.0	15	0.022	180.0	-	0.000	0.0	9	0.000	0.0
7	0.489	0.0	16	0.000	0.0	-	0.000	0.0	10	0.081	180.0
8	0.180	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.021	-23.2	9	0.023	180.0	9	0.000	0.0	-	0.000	0.0
10	0.091	180.0	12	0.022	180.0	-	0.000	0.0	1	0.035	180.0
NF 5	68.092	56.7	5	85.961	93.6	5	88.229	58.0	5	67.206	238.0

MODE= 1T, RPM= 680, FREQUENCY= 46.14 HZ (BLADE 8), 45.54 HZ (BLADE 5), DAMPING= 0.51 %

RECORD NO. 332 MUX 1 (BLD 8)			RECORD NO. 333 MUX 2 (BLD 8)			RECORD NO. 334 MUX 3 (BLD 8)			RECORD NO. 334 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.405	-52.1	1	0.174	-34.6	1	0.280	47.9	-	0.000	0.0
2	0.028	180.0	11	0.099	180.0	-	0.000	0.0	-	0.000	0.0
3	0.356	180.0	13	0.074	10.2	-	0.000	0.0	5	5.190	10.8
4	0.289	180.0	14	0.000	0.0	-	0.000	0.0	8	0.000	0.0
5	0.376	180.0	5	0.283	-152.6	5	0.228	0.0	-	0.000	0.0
6	0.244	180.0	15	0.308	0.0	-	0.000	0.0	9	1.000	0.0
7	0.149	180.0	16	0.040	-21.4	-	0.000	0.0	10	0.788	180.0
8	0.624	-60.5	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	1.000	0.0	9	1.000	0.0	9	1.000	0.0	-	0.000	0.0
10	0.065	180.0	12	0.904	0.0	-	0.000	0.0	1	3.351	132.6
NF 9	52.320	127.0	9	41.664	117.5	9	50.429	161.5	9	3.065	29.0

TABLE 13 MODAL PARAMETERS FOR CONFIGURATION 1(b) AT 1000 RPM

MODE= 1F, RPM= 1000, FREQUENCY= 19.04 HZ (BLADE 8), 18.69 HZ (BLADE 5), DAMPING= 0.17 %

RECORD NO. 301 MUX 1 (BLD 8)			RECORD NO. 302 MUX 2 (BLD 8)			RECORD NO. 303 MUX 3 (BLD 8)			RECORD NO. 303 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.231	21.1	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.057	38.3	13	0.000	0.0	-	0.000	0.0	5	1.605	180.0
4	0.024	38.7	14	0.023	65.0	-	0.000	0.0	8	1.304	0.0
5	1.067	0.0	5	0.417	180.0	5	1.026	0.0	-	0.000	0.0
6	0.704	0.0	15	0.000	0.0	-	0.000	0.0	9	0.141	-12.9
7	0.542	0.0	16	0.026	0.0	-	0.000	0.0	10	0.334	180.0
8	1.071	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.418	0.0	9	0.429	0.0	9	0.410	0.0	-	0.000	0.0
10	0.207	-142.4	12	0.062	0.0	-	0.000	0.0	1	1.000	0.0
NF 1	35.186	132.2	1	20.028	115.7	1	13.471	164.0	1	9.306	38.3

MODE= 2F, RPM= 1000, FREQUENCY= 55.66 HZ (BLADE 8), 55.71 HZ (BLADE 5), DAMPING=-0.05 %

RECORD NO. 304 MUX 1 (BLD 8)			RECORD NO. 305 MUX 2 (BLD 8)			RECORD NO. 306 MUX 3 (BLD 8)			RECORD NO. 306 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.900	0.0	11	0.515	180.0	-	0.000	0.0	-	0.000	0.0
3	0.782	180.0	13	0.121	-10.3	-	0.000	0.0	5	0.592	-140.3
4	0.734	180.0	14	0.418	180.0	-	0.000	0.0	8	1.071	0.0
5	1.065	180.0	5	0.888	180.0	5	0.719	-101.4	-	0.900	0.0
6	0.787	180.0	15	0.073	0.0	-	0.000	0.0	9	0.735	180.0
7	0.655	169.6	16	0.088	0.0	-	0.000	0.0	10	0.270	180.0
8	0.872	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.693	0.0	9	0.692	0.0	9	0.693	0.0	-	0.000	0.0
10	0.106	180.0	12	0.095	0.0	-	0.000	0.0	1	1.000	0.0
NF 1	26.410	-177.8	1	31.335	116.6	1	28.775	120.3	1	33.484	120.3

MODE= 3F, RPM= 1000, FREQUENCY=117.05 HZ (BLADE 8), 116.81 HZ (BLADE 5), DAMPING= 0.27 %

RECORD NO. 308 MUX 1 (BLD 8)			RECORD NO. 309 MUX 2 (BLD 8)			RECORD NO. 310 MUX 3 (BLD 8)			RECORD NO. 310 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.783	150.9	11	0.818	180.0	-	0.000	0.0	-	0.000	0.0
3	0.273	180.0	13	0.183	0.0	-	0.000	0.0	5	0.293	166.9
4	1.823	-29.2	14	1.034	0.0	-	0.000	0.0	8	1.100	0.0
5	0.170	0.0	5	0.119	131.4	5	0.152	-36.0	-	0.000	0.0
6	0.228	180.0	15	0.674	0.0	-	0.000	0.0	9	0.230	0.0
7	0.361	180.0	16	0.205	180.0	-	0.000	0.0	10	0.000	0.0
8	1.081	-29.8	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.130	17.8	9	0.127	-27.8	9	0.055	41.7	-	0.000	0.0
10	0.211	156.3	12	0.281	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	21.702	-84.9	1	28.626	-75.4	1	21.745	-62.4	1	19.129	-49.3

MODE= 1E, RPM= 1000, FREQUENCY= 25.32 HZ (BLADE 8), 25.24 HZ (BLADE 5), DAMPING= 0.91 %

RECORD NO. 311 MUX 1 (BLD 8)			RECORD NO. 312 MUX 2 (BLD 8)			RECORD NO. 313 MUX 3 (BLD 8)			RECORD NO. 313 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.000	0.0	1	0.023	180.0	1	0.021	-150.1	-	0.000	0.0
2	0.000	0.0	11	0.065	0.0	-	0.000	0.0	-	0.000	0.0
3	0.000	0.0	13	0.032	180.0	-	0.000	0.0	5	1.000	0.0
4	0.000	0.0	14	0.000	0.0	-	0.000	0.0	8	0.153	0.0
5	1.000	0.0	5	1.000	0.0	5	1.000	0.0	-	0.000	0.0
6	0.578	0.0	15	0.021	180.0	-	0.000	0.0	9	0.043	180.0
7	0.443	0.0	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
8	0.151	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.000	0.0	9	0.000	0.0	9	0.000	0.0	-	0.000	0.0
10	0.089	180.0	12	0.000	0.0	-	0.000	0.0	1	0.036	-159.7
NF 5	79.464	-92.9	5	79.233	-106.7	5	65.588	-26.0	5	51.467	154.0

MODE= 1T, RPM= 1000, FREQUENCY= 47.57 HZ (BLADE 8), 50.05 HZ (BLADE 5), DAMPING=-0.08 %

RECORD NO. 314 MUX 1 (BLD 8)			RECORD NO. 315 MUX 2 (BLD 8)			RECORD NO. 316 MUX 3 (BLD 8)			RECORD NO. 316 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.098	161.9	1	0.097	180.0	1	0.098	166.6	-	0.000	0.0
2	0.000	0.0	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.068	19.6	13	0.046	0.0	-	0.000	0.0	5	1.022	49.8
4	0.066	20.0	14	0.023	180.0	-	0.000	0.0	8	0.086	134.6
5	0.512	46.0	5	0.470	109.0	5	0.493	30.8	-	0.000	0.0
6	0.358	45.0	15	0.386	0.0	-	0.000	0.0	9	1.000	0.0
7	0.285	35.9	16	0.023	99.1	-	0.000	0.0	10	0.000	0.0
8	0.105	180.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	1.000	0.0	9	1.000	0.0	9	1.000	0.0	-	0.000	0.0
10	0.063	11.9	12	1.057	0.0	-	0.000	0.0	1	0.123	180.0
NF 9	37.547	-92.1	9	38.189	-144.1	9	36.723	-77.9	9	14.564	-147.8

TABLE 14 MODAL PARAMETERS FOR CONFIGURATION 2 AT 0 RPM

MODE= 1F, RPM= 0, FREQUENCY= 5.19 HZ (BLADE 8), 5.35 HZ (BLADE 5), DAMPING= 0.79 %

RECORD NO. 588 MUX 1 (BLD 8)			RECORD NO. 589 MUX 2 (BLD 8)			RECORD NO. 590 MUX 3 (BLD 8)			RECORD NO. 590 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.725	0.0	11	0.468	0.0	-	0.000	0.0	-	0.000	0.0
3	0.369	0.0	13	0.077	180.0	-	0.000	0.0	5	0.221	141.0
4	0.130	0.0	14	0.055	0.0	-	0.000	0.0	8	1.018	0.0
5	0.148	180.0	5	0.150	180.0	5	0.146	180.0	-	0.000	0.0
6	0.043	180.0	15	0.031	180.0	-	0.000	0.0	9	0.165	0.0
7	0.000	0.0	16	0.000	0.0	-	0.000	0.0	10	0.217	141.0
8	0.880	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.398	0.0	9	0.270	53.1	9	0.399	0.0	-	0.000	0.0
10	0.097	180.0	12	0.223	0.0	-	0.000	0.0	1	1.000	0.0
NF 1	8.080	94.5	1	8.609	92.4	1	8.039	-87.9	1	7.570	-48.9

MODE= 2F, RPM= 0, FREQUENCY= 32.20 HZ (BLADE 8), 33.43 HZ (BLADE 5), DAMPING= 0.49 %

RECORD NO. 591 MUX 1 (BLD 8)			RECORD NO. 592 MUX 2 (BLD 8)			RECORD NO. 593 MUX 3 (BLD 8)			RECORD NO. 593 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.145	39.8	11	0.541	180.0	-	0.000	0.0	-	0.000	0.0
3	1.221	143.2	13	0.120	30.5	-	0.000	0.0	5	0.150	180.0
4	0.650	180.0	14	0.428	-143.0	-	0.000	0.0	8	1.056	0.0
5	0.268	137.1	5	0.000	0.0	5	0.249	-140.4	-	0.000	0.0
6	0.000	0.0	15	0.000	0.0	-	0.000	0.0	9	0.133	0.0
7	0.079	42.6	16	0.000	0.0	-	0.000	0.0	10	0.235	180.0
8	0.829	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.311	35.6	9	0.325	32.5	9	0.321	36.1	-	0.000	0.0
10	0.154	-138.3	12	0.544	141.8	-	0.000	0.0	1	1.000	0.0
NF 1	10.177	-16.0	1	10.875	24.0	1	10.852	25.8	1	3.939	205.8

MODE= 3F, RPM= 0, FREQUENCY= 90.58 HZ (BLADE 8), 89.33 HZ (BLADE 5), DAMPING= 1.08 %

RECORD NO. 594 MUX 1 (BLD 8)			RECORD NO. 595 MUX 2 (BLD 8)			RECORD NO. 596 MUX 3 (BLD 8)			RECORD NO. 596 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.592	180.0	11	0.842	180.0	-	0.000	0.0	-	0.000	0.0
3	0.118	180.0	13	0.187	-11.5	-	0.000	0.0	5	0.216	-162.9
4	1.253	0.0	14	0.846	0.0	-	0.000	0.0	8	1.091	0.0
5	0.105	180.0	5	0.136	-33.1	5	0.133	180.0	-	0.000	0.0
6	0.101	0.0	15	0.418	0.0	-	0.000	0.0	9	0.214	-91.7
7	0.046	145.3	16	0.151	180.0	-	0.000	0.0	10	0.259	180.0
8	0.857	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.326	0.0	9	0.329	0.0	9	0.298	0.0	-	0.000	0.0
10	0.121	180.0	12	0.437	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	2.931	-131.0	1	2.829	17.0	1	3.097	-114.3	1	3.401	37.8

MODE= 1E, RPM= 0, FREQUENCY= 22.03 HZ (BLADE 8), 22.05 HZ (BLADE 5), DAMPING= 0.51 %

RECORD NO. 597 MUX 1 (BLD 8)			RECORD NO. 600 MUX 2 (BLD 8)			RECORD NO. 601 MUX 3 (BLD 8)			RECORD NO. 601 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.003	0.0	1	0.000	0.0	1	0.000	0.0	-	0.000	0.0
2	0.003	0.0	11	0.075	0.0	-	0.000	0.0	-	0.000	0.0
3	0.003	0.0	13	0.034	180.0	-	0.000	0.0	5	1.000	0.0
4	0.000	0.0	14	0.000	0.0	-	0.000	0.0	8	0.151	0.0
5	1.003	0.0	5	1.000	0.0	5	1.000	0.0	-	0.000	0.0
6	0.663	0.0	15	0.000	0.0	-	0.000	0.0	9	0.115	0.0
7	0.529	0.0	16	0.000	0.0	-	0.000	0.0	10	0.084	180.0
8	0.196	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.147	0.0	9	0.147	0.0	9	0.150	0.0	-	0.000	0.0
10	0.079	180.0	12	0.035	0.0	-	0.000	0.0	1	0.000	0.0
NF 5	15.801	-6.6	5	16.181	16.3	5	16.592	-81.9	5	13.612	98.1

MODE= 1T, RPM= 0, FREQUENCY= 37.96 HZ (BLADE 8), 37.80 HZ (BLADE 5), DAMPING= 0.56 %

RECORD NO. 605 MUX 1 (BLD 8)			RECORD NO. 606 MUX 2 (BLD 8)			RECORD NO. 607 MUX 3 (BLD 8)			RECORD NO. 607 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.062	0.0	1	0.070	0.0	1	0.063	0.0	-	0.000	0.0
2	0.000	0.0	11	0.046	180.0	-	0.000	0.0	-	0.000	0.0
3	0.091	180.0	13	0.043	-54.9	-	0.000	0.0	5	1.257	-94.2
4	0.053	180.0	14	0.037	180.0	-	0.000	0.0	8	0.359	-90.1
5	0.333	180.0	5	0.332	180.0	5	0.328	180.0	-	0.000	0.0
6	0.166	180.0	15	0.302	0.0	-	0.000	0.0	9	1.000	0.0
7	0.049	180.0	16	0.027	0.0	-	0.000	0.0	10	0.000	0.0
8	0.201	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	1.003	0.0	9	1.000	0.0	9	1.000	0.0	-	0.000	0.0
10	0.036	0.0	12	0.916	0.0	-	0.000	0.0	1	0.000	0.0
NF 9	7.192	67.4	9	7.381	115.0	9	7.057	-17.8	9	0.740	-17.8

TABLE 15 MODAL PARAMETERS FOR CONFIGURATION 2 AT 775 RPM

MODE= 1F, RPM= 775, FREQUENCY= 15.46 HZ (BLADE 8), 15.54 HZ (BLADE 5), DAMPING= 0.10 %

RECORD NO. 629 MUX 1 (BLD 8)			RECORD NO. 630 MUX 2 (BLD 8)			RECORD NO. 631 MUX 3 (BLD 8)			RECORD NO. 631 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.392	0.0	11	0.156	0.0	-	0.000	0.0	-	0.000	0.0
3	0.102	0.0	13	0.027	-136.8	-	0.000	0.0	5	0.160	180.0
4	0.043	0.0	14	0.000	0.0	-	0.000	0.0	8	1.071	0.0
5	0.105	180.0	5	0.095	-120.5	5	0.110	0.0	-	0.000	0.0
6	0.031	180.0	15	0.000	0.0	-	0.000	0.0	9	0.172	0.0
7	0.071	180.0	16	0.000	0.0	-	0.000	0.0	10	0.246	180.0
8	0.896	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.412	0.0	9	0.414	0.0	9	0.409	0.0	-	0.000	0.0
10	0.123	180.0	12	0.079	53.4	-	0.000	0.0	1	1.000	0.0
NF 1	14.791	-151.6	1	17.985	7.2	1	14.838	-179.6	1	4.881	0.4

MODE= 2F, RPM= 775, FREQUENCY= 47.06 HZ (BLADE 8), 51.50 HZ (BLADE 5), DAMPING= 0.23 %

RECORD NO. 632 MUX 1 (BLD 8)			RECORD NO. 633 MUX 2 (BLD 8)			RECORD NO. 634 MUX 3 (BLD 8)			RECORD NO. 634 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.092	70.4	11	0.575	180.0	-	0.000	0.0	-	0.000	0.0
3	0.880	180.0	13	0.125	0.0	-	0.000	0.0	5	1.408	-128.3
4	0.752	180.0	14	0.405	180.0	-	0.000	0.0	8	1.099	0.0
5	0.502	71.8	5	0.408	34.4	5	0.604	-41.7	-	0.000	0.0
6	0.444	49.6	15	0.152	-120.7	-	0.000	0.0	9	0.509	0.0
7	0.403	51.7	16	0.149	118.9	-	0.000	0.0	10	0.274	180.0
8	0.921	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.722	0.0	9	0.722	0.0	9	0.707	0.0	-	0.000	0.0
10	0.078	180.0	12	0.192	105.5	-	0.000	0.0	1	1.000	0.0
NF 1	6.111	-79.9	1	6.607	1.7	1	7.492	-106.7	1	4.451	73.3

DATA NOT AVAILABLE

MODE= 1E, RPM= 775, FREQUENCY= 22.32 HZ (BLADE 8), 22.40 HZ (BLADE 5), DAMPING= 0.72 %

RECORD NO. 626 MUX 1 (BLD 8)			RECORD NO. 627 MUX 2 (BLD 8)			RECORD NO. 628 MUX 3 (BLD 8)			RECORD NO. 628 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.035	-140.1	1	0.036	-112.0	1	0.037	-152.1	-	0.000	0.0
2	0.000	0.0	11	0.074	0.0	-	0.000	0.0	-	0.000	0.0
3	0.000	0.0	13	0.034	180.0	-	0.000	0.0	5	1.000	0.0
4	0.000	0.0	14	0.000	0.0	-	0.000	0.0	8	0.171	0.0
5	1.000	0.0	5	1.000	0.0	5	1.000	0.0	-	0.000	0.0
6	0.605	0.0	15	0.020	180.0	-	0.000	0.0	9	0.029	180.0
7	0.467	0.0	16	0.000	0.0	-	0.000	0.0	10	0.077	180.0
8	0.162	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.025	180.0	9	0.025	-107.3	9	0.024	-146.8	-	0.000	0.0
10	0.082	180.0	12	0.000	0.0	-	0.000	0.0	1	0.030	-150.8
NF 5	80.436	125.3	5	86.663	160.3	5	84.914	-178.7	5	63.953	1.1

MODE= 1T, RPM= 775, FREQUENCY= 41.26 HZ (BLADE 8), 39.40 HZ (BLADE 5), DAMPING= 0.97 %

RECORD NO. 635 MUX 1 (BLD 8)			RECORD NO. 636 MUX 2 (BLD 8)			RECORD NO. 637 MUX 3 (BLD 8)			RECORD NO. 637 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.078	0.0	1	0.150	90.4	1	0.105	-86.1	-	0.000	0.0
2	0.082	44.9	11	0.539	180.0	-	0.000	0.0	-	0.000	0.0
3	0.201	139.0	13	0.204	-35.2	-	0.000	0.0	5	17.659	87.6
4	0.127	22.8	14	0.111	-65.9	-	0.000	0.0	8	2.761	81.7
5	6.273	-48.2	5	5.954	180.0	5	5.373	94.8	-	0.000	0.0
6	4.272	-49.0	15	0.284	180.0	-	0.000	0.0	9	1.000	0.0
7	3.493	-50.0	16	0.151	16.0	-	0.000	0.0	10	1.211	-74.9
8	1.093	-53.8	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	1.000	0.0	9	1.000	0.0	9	1.000	0.0	-	0.000	0.0
10	0.469	133.0	12	0.950	111.9	-	0.000	0.0	1	0.222	153.2
NF 9	7.891	78.1	9	8.075	120.7	9	7.739	71.6	9	2.046	82.2

TABLE 16 MODAL PARAMETERS FOR CONFIGURATION 2 AT 1000 RPM

MODE= 1F, RPM= 1000, FREQUENCY= 19.37 HZ (BLADE 8), 19.30 HZ (BLADE 5), DAMPING= 0.09 %

RECORD NO. 608 MUX 1 (BLD 8) SG#	AMP (MU-STRN)	PHS (DEG)	RECORD NO. 609 MUX 2 (BLD 8) SG#	AMP (MU-STRN)	PHS (DEG)	RECORD NO. 610 MUX 3 (BLD 8) SG#	AMP (MU-STRN)	PHS (DEG)	RECORD NO. 610 MUX 3 (BLD 5) SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.310	0.0	11	0.113	0.0	-	0.000	0.0	-	0.000	0.0
3	0.065	0.0	13	0.023	180.0	-	0.000	0.0	5	1.415	-55.7
4	0.027	0.0	14	0.000	0.0	-	0.000	0.0	8	1.145	0.0
5	0.339	-127.8	5	0.402	-53.3	5	0.488	-38.3	-	0.000	0.0
6	0.185	-127.0	15	0.000	0.0	-	0.000	0.0	9	0.172	0.0
7	0.136	-126.9	16	0.000	0.0	-	0.000	0.0	10	0.291	180.0
8	0.918	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.416	0.0	9	0.417	0.0	9	0.418	0.0	-	0.000	0.0
10	0.138	180.0	12	0.056	0.0	-	0.000	0.0	1	1.000	0.0
NF 1	40.088	56.4	1	36.013	-98.2	1	29.705	-147.2	1	8.199	32.8

MODE= 2F, RPM= 1000, FREQUENCY= 54.72 HZ (BLADE 8), 55.03 HZ (BLADE 5), DAMPING= 0.21 %

RECORD NO. 611 MUX 1 (BLD 8) SG#	AMP (MU-STRN)	PHS (DEG)	RECORD NO. 612 MUX 2 (BLD 8) SG#	AMP (MU-STRN)	PHS (DEG)	RECORD NO. 613 MUX 3 (BLD 8) SG#	AMP (MU-STRN)	PHS (DEG)	RECORD NO. 613 MUX 3 (BLD 5) SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.065	105.2	11	0.872	-149.5	-	0.000	0.0	-	0.000	0.0
3	0.838	180.0	13	0.175	-43.2	-	0.000	0.0	5	0.099	-140.5
4	0.581	180.0	14	0.588	180.0	-	0.000	0.0	8	1.240	-159.0
5	6.671	180.0	5	9.002	180.0	5	7.399	46.9	-	0.000	0.0
6	4.684	180.0	15	0.558	-27.9	-	0.000	0.0	9	0.501	0.0
7	3.913	180.0	16	0.219	180.0	-	0.000	0.0	10	0.388	0.0
8	1.290	180.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.619	0.0	9	0.834	-34.8	9	0.564	0.0	-	0.000	0.0
10	0.559	52.7	12	0.211	-46.3	-	0.000	0.0	1	1.000	0.0
NF 1	4.440	-100.3	1	4.423	124.7	1	4.253	-127.7	1	3.218	52.3

MODE= 3F, RPM= 1000, FREQUENCY=115.83 HZ (BLADE 8), 115.75 HZ (BLADE 5), DAMPING= 0.50 %

RECORD NO. 616 MUX 1 (BLD 8) SG#	AMP (MU-STRN)	PHS (DEG)	RECORD NO. 615 MUX 2 (BLD 8) SG#	AMP (MU-STRN)	PHS (DEG)	RECORD NO. 614 MUX 3 (BLD 8) SG#	AMP (MU-STRN)	PHS (DEG)	RECORD NO. 614 MUX 3 (BLD 5) SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.671	180.0	11	0.981	180.0	-	0.000	0.0	-	0.000	0.0
3	0.232	180.0	13	0.288	-16.7	-	0.000	0.0	5	1.087	46.0
4	1.514	0.0	14	0.968	15.1	-	0.000	0.0	8	1.010	0.0
5	0.730	-92.7	5	0.538	-136.4	5	1.356	80.0	-	0.000	0.0
6	0.979	75.9	15	0.555	16.2	-	0.000	0.0	9	0.618	-75.9
7	1.379	76.2	16	0.248	-162.3	-	0.000	0.0	10	0.372	-105.1
8	0.866	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.288	124.2	9	0.226	59.4	9	0.782	180.0	-	0.000	0.0
10	0.166	127.7	12	0.499	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	5.440	7.9	1	5.611	50.5	1	3.015	-172.2	1	2.589	-38.2

MODE= 1E, RPM= 1000, FREQUENCY= 22.51 HZ (BLADE 8), 22.49 HZ (BLADE 5), DAMPING= 0.93 %

RECORD NO. 617 MUX 1 (BLD 8) SG#	AMP (MU-STRN)	PHS (DEG)	RECORD NO. 618 MUX 2 (BLD 8) SG#	AMP (MU-STRN)	PHS (DEG)	RECORD NO. 619 MUX 3 (BLD 8) SG#	AMP (MU-STRN)	PHS (DEG)	RECORD NO. 619 MUX 3 (BLD 5) SG#	AMP (MU-STRN)	PHS (DEG)
1	0.000	0.0	1	0.000	0.0	1	0.000	0.0	-	0.000	0.0
2	0.000	0.0	11	0.069	0.0	-	0.000	0.0	-	0.000	0.0
3	0.000	0.0	13	0.030	180.0	-	0.000	0.0	5	1.000	0.0
4	0.000	0.0	14	0.000	0.0	-	0.000	0.0	8	0.176	0.0
5	1.000	0.0	5	1.000	0.0	5	1.000	0.0	-	0.000	0.0
6	0.571	0.0	15	0.000	0.0	-	0.000	0.0	9	0.053	180.0
7	0.438	0.0	16	0.000	0.0	-	0.000	0.0	10	0.078	180.0
8	0.151	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.028	180.0	9	0.028	180.0	9	0.030	180.0	-	0.000	0.0
10	0.078	180.0	12	0.000	0.0	-	0.000	0.0	1	0.026	-114.9
NF 5	53.140	-124.7	5	50.622	-30.9	5	50.956	-177.1	5	39.092	2.9

MODE= 1T, RPM= 1000, FREQUENCY= 44.10 HZ (BLADE 8), 50.20 HZ (BLADE 5), DAMPING= 0.37 %

RECORD NO. 623 MUX 1 (BLD 8) SG#	AMP (MU-STRN)	PHS (DEG)	RECORD NO. 624 MUX 2 (BLD 8) SG#	AMP (MU-STRN)	PHS (DEG)	RECORD NO. 625 MUX 3 (BLD 8) SG#	AMP (MU-STRN)	PHS (DEG)	RECORD NO. 625 MUX 3 (BLD 5) SG#	AMP (MU-STRN)	PHS (DEG)
1	0.000	0.0	1	0.099	-77.0	1	0.136	129.3	-	0.000	0.0
2	0.000	0.0	11	0.068	0.0	-	0.000	0.0	-	0.000	0.0
3	0.000	0.0	13	0.047	-22.7	-	0.000	0.0	5	12.338	180.0
4	0.192	-108.5	14	0.040	57.7	-	0.000	0.0	8	1.928	180.0
5	3.334	37.3	5	0.786	180.0	5	3.335	129.3	-	0.000	0.0
6	2.361	43.1	15	0.371	0.0	-	0.000	0.0	9	1.000	0.0
7	0.000	0.0	16	0.026	0.0	-	0.000	0.0	10	0.458	12.2
8	0.653	38.5	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	1.000	0.0	9	1.000	0.0	9	1.000	0.0	-	0.000	0.0
10	0.258	-144.1	12	1.017	0.0	-	0.000	0.0	1	0.863	45.1
NF 9	8.006	77.2	9	6.914	-57.1	9	7.597	6.1	9	1.810	-84.2

TABLE 17 MODAL PARAMETERS FOR CONFIGURATION 3(a) AT 0 RPM

MODE= 1F, RPM= 0, FREQUENCY= 5.19 HZ (BLADE 8), 5.37 HZ (BLADE 5), DAMPING= 0.63 %

RECORD NO. 704 MUX 1 (BLD 8)			RECORD NO. 706 MUX 2 (BLD 8)			RECORD NO. 707 MUX 3 (BLD 8)			RECORD NO. 707 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.741	0.0	11	9.581	-58.8	-	0.000	0.0	-	0.000	0.0
3	0.369	0.0	13	0.073	160.0	-	0.000	0.0	5	0.000	0.0
4	0.132	0.0	14	0.053	0.0	-	0.000	0.0	8	1.061	0.0
5	0.150	180.0	5	0.145	180.0	5	0.137	169.3	-	0.000	0.0
6	0.032	-128.7	15	0.020	51.0	-	0.000	0.0	9	0.000	0.0
7	0.045	180.0	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
8	0.885	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.396	0.0	9	0.402	0.0	9	0.401	0.0	-	0.000	0.0
10	0.103	180.0	12	0.231	0.0	-	0.000	0.0	1	1.000	0.0
NF 1	24.284	92.9	1	22.013	-43.9	1	25.061	25.2	1	3.483	-92.2

MODE= 2F, RPM= 0, FREQUENCY= 32.28 HZ (BLADE 8), 33.03 HZ (BLADE 5), DAMPING= 0.62 %

RECORD NO. 708 MUX 1 (BLD 8)			RECORD NO. 709 MUX 2 (BLD 8)			RECORD NO. 710 MUX 3 (BLD 8)			RECORD NO. 710 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.188	0.0	11	7.243	89.8	-	0.000	0.0	-	0.000	0.0
3	0.895	180.0	13	0.000	0.0	-	0.000	0.0	5	0.196	55.5
4	0.643	180.0	14	0.308	180.0	-	0.000	0.0	8	1.161	0.0
5	0.259	180.0	5	0.229	180.0	5	0.221	180.0	-	0.000	0.0
6	0.048	115.2	15	0.172	180.0	-	0.000	0.0	9	0.205	32.6
7	0.000	0.0	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
8	0.000	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.301	0.0	9	0.326	0.0	9	0.291	0.0	-	0.000	0.0
10	0.000	0.0	12	0.320	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	11.791	-96.5	1	11.462	-137.0	1	11.459	-165.7	1	3.092	-41.2

MODE= 3F, RPM= 0, FREQUENCY= 90.58 HZ (BLADE 8), 90.47 HZ (BLADE 5), DAMPING= 1.24 %

RECORD NO. 711 MUX 1 (BLD 8)			RECORD NO. 712 MUX 2 (BLD 8)			RECORD NO. 713 MUX 3 (BLD 8)			RECORD NO. 713 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	1.018	-162.5	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.104	0.0	13	0.183	90.4	-	0.000	0.0	5	0.266	-93.9
4	1.228	0.0	14	0.811	0.0	-	0.000	0.0	8	0.793	68.2
5	0.000	0.0	5	0.095	180.0	5	0.000	0.0	-	0.000	0.0
6	0.029	44.4	15	0.436	0.0	-	0.000	0.0	9	0.300	0.0
7	0.003	0.0	16	0.155	180.0	-	0.000	0.0	10	0.000	0.0
8	0.000	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.366	88.4	9	0.316	97.0	9	0.439	12.7	-	0.000	0.0
10	0.000	0.0	12	0.402	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	4.385	120.2	1	4.548	-80.0	1	4.743	76.6	1	2.780	188.4

MODE= 1E, RPM= 0, FREQUENCY= 23.76 HZ (BLADE 8), 23.70 HZ (BLADE 5), DAMPING= 0.66 %

RECORD NO. 714 MUX 1 (BLD 8)			RECORD NO. 715 MUX 2 (BLD 8)			RECORD NO. 716 MUX 3 (BLD 8)			RECORD NO. 716 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.023	0.0	1	0.023	0.0	1	0.023	0.0	-	0.000	0.0
2	0.003	0.0	11	2.043	180.0	-	0.000	0.0	-	0.000	0.0
3	0.003	0.0	13	0.033	180.0	-	0.000	0.0	5	1.000	0.0
4	0.003	0.0	14	0.000	0.0	-	0.000	0.0	8	0.144	0.0
5	1.000	0.0	5	1.000	0.0	5	1.000	0.0	-	0.000	0.0
6	0.667	0.0	15	0.023	180.0	-	0.000	0.0	9	0.102	0.0
7	0.529	0.0	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
8	0.199	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.135	0.0	9	0.133	0.0	9	0.136	0.0	-	0.000	0.0
10	0.078	180.0	12	0.000	0.0	-	0.000	0.0	1	0.024	180.0
NF 5	107.005	37.1	5	106.857	-16.5	5	106.406	-154.6	5	88.906	25.4

MODE= 1T, RPM= 0, FREQUENCY= 44.14 HZ (BLADE 8), 50.16 HZ (BLADE 5), DAMPING= 0.48 %

RECORD NO. 718 MUX 1 (BLD 8)			RECORD NO. 719 MUX 2 (BLD 8)			RECORD NO. 720 MUX 3 (BLD 8)			RECORD NO. 720 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.003	0.0	1	0.000	0.0	1	0.000	0.0	-	0.000	0.0
2	0.043	79.7	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.035	180.0	13	0.036	57.7	-	0.000	0.0	5	0.000	0.0
4	0.003	0.0	14	0.000	0.0	-	0.000	0.0	8	1.724	180.0
5	0.201	180.0	5	0.197	180.0	5	0.236	180.0	-	0.000	0.0
6	0.086	180.0	15	0.340	0.0	-	0.000	0.0	9	1.000	0.0
7	0.003	0.0	16	0.031	0.0	-	0.000	0.0	10	0.000	0.0
8	0.186	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	1.003	0.0	9	1.000	0.0	9	1.000	0.0	-	0.000	0.0
10	0.003	0.0	12	1.009	0.0	-	0.000	0.0	1	0.000	0.0
NF 9	6.185	-144.3	9	6.306	-66.5	9	5.921	29.6	9	0.160	170.7

TABLE 18 MODAL PARAMETERS FOR CONFIGURATION 3(a) AT 1000 RPM

MODE= 1F, RPM= 1000, FREQUENCY= 20.32 HZ (BLADE 8), 19.40 HZ (BLADE 5), DAMPING=-0.87 %

RECORD NO. 733			RECORD NO. 734			RECORD NO. 735			RECORD NO. 735		
MUX 1 (BLD 8)			MUX 2 (BLD 8)			MUX 3 (BLD 8)			MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.307	0.0	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.065	0.0	13	0.022	168.7	-	0.000	0.0	5	0.473	-66.4
4	0.028	0.0	14	0.000	0.0	-	0.000	0.0	8	1.081	0.0
5	0.176	-76.1	5	0.182	180.0	5	0.163	180.0	-	0.000	0.0
6	0.113	-46.1	15	0.000	0.0	-	0.000	0.0	9	0.280	0.0
7	0.000	0.0	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
8	0.892	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.440	0.0	9	0.440	0.0	9	0.437	0.0	-	0.000	0.0
10	0.119	180.0	12	0.055	0.0	-	0.000	0.0	1	1.000	0.0
NF 1	0.002	45.9	1	41.378	-169.4	1	32.834	-123.5	1	10.219	56.5

MODE= 2F, RPM= 1000, FREQUENCY= 55.12 HZ (BLADE 8), 55.30 HZ (BLADE 5), DAMPING= 0.78 %

RECORD NO. 730			RECORD NO. 731			RECORD NO. 732			RECORD NO. 732		
MUX 1 (BLD 8)			MUX 2 (BLD 8)			MUX 3 (BLD 8)			MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.099	-12.4	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.830	180.0	13	0.213	-11.8	-	0.000	0.0	5	1.838	0.0
4	0.767	180.0	14	0.440	180.0	-	0.000	0.0	8	1.051	0.0
5	5.694	0.0	5	4.386	180.0	5	4.347	180.0	-	0.000	0.0
6	3.928	0.0	15	1.072	-42.2	-	0.000	0.0	9	6.196	0.0
7	0.000	0.0	16	0.100	36.1	-	0.000	0.0	10	0.000	0.0
8	0.000	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	1.894	180.0	9	1.350	-18.3	9	1.175	-82.1	-	0.000	0.0
10	0.306	180.0	12	2.570	-36.4	-	0.000	0.0	1	1.000	0.0
NF 1	7.976	-42.3	1	13.142	157.8	1	11.092	152.2	1	9.088	332.2

MODE= 3F, RPM= 1000, FREQUENCY=116.72 HZ (BLADE 8), 116.36 HZ (BLADE 5), DAMPING= 0.17 %

RECORD NO. 727			RECORD NO. 728			RECORD NO. 729			RECORD NO. 729		
MUX 1 (BLD 8)			MUX 2 (BLD 8)			MUX 3 (BLD 8)			MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.680	180.0	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.209	180.0	13	0.219	-11.3	-	0.000	0.0	5	0.391	11.2
4	1.465	0.0	14	1.087	0.0	-	0.000	0.0	8	1.187	0.0
5	0.194	15.9	5	0.096	166.0	5	0.145	-48.6	-	0.000	0.0
6	0.418	0.0	15	0.694	0.0	-	0.000	0.0	9	0.248	-14.5
7	0.000	0.0	16	0.265	180.0	-	0.000	0.0	10	0.000	0.0
8	0.000	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.274	-107.0	9	0.210	180.0	9	0.215	0.0	-	0.000	0.0
10	0.141	-159.9	12	0.311	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	9.405	163.2	1	12.787	-162.6	1	10.702	162.8	1	4.235	61.0

MODE= 1E, RPM= 1000, FREQUENCY= 24.50 HZ (BLADE 8), 24.45 HZ (BLADE 5), DAMPING= 0.98 %

RECORD NO. 724			RECORD NO. 725			RECORD NO. 726			RECORD NO. 726		
MUX 1 (BLD 8)			MUX 2 (BLD 8)			MUX 3 (BLD 8)			MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.000	0.0	1	0.000	0.0	1	0.000	0.0	-	0.000	0.0
2	0.000	0.0	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.000	0.0	13	0.030	180.0	-	0.000	0.0	5	1.000	0.0
4	0.000	0.0	14	0.000	0.0	-	0.000	0.0	8	0.164	0.0
5	1.000	0.0	5	1.000	0.0	5	1.000	0.0	-	0.000	0.0
6	0.561	0.0	15	0.000	0.0	-	0.000	0.0	9	0.214	0.0
7	0.000	0.0	16	0.000	0.0	-	0.000	0.0	10	0.059	180.0
8	0.000	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.219	0.0	9	0.211	0.0	9	0.212	0.0	-	0.000	0.0
10	0.040	180.0	12	0.000	0.0	-	0.000	0.0	1	0.000	0.0
NF 5	63.806	91.7	5	67.728	-39.8	5	63.833	99.4	5	45.921	279.4

MODE= 1T, RPM= 1012, FREQUENCY= 48.64 HZ (BLADE 8), 50.59 HZ (BLADE 5), DAMPING= 1.39 %

RECORD NO. 721			RECORD NO. 722			RECORD NO. 723			RECORD NO. 723		
MUX 1 (BLD 8)			MUX 2 (BLD 8)			MUX 3 (BLD 8)			MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.312	180.0	1	0.332	133.0	1	0.313	180.0	-	0.000	0.0
2	0.027	-105.0	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.279	-27.6	13	0.172	-17.2	-	0.000	0.0	5	0.222	180.0
4	0.250	-27.0	14	0.113	-56.5	-	0.000	0.0	8	0.097	180.0
5	3.534	-126.7	5	3.709	128.8	5	3.603	180.0	-	0.000	0.0
6	2.480	-124.9	15	0.828	-34.0	-	0.000	0.0	9	1.000	0.0
7	1.991	-124.1	16	0.092	33.2	-	0.000	0.0	10	0.000	0.0
8	0.527	-126.9	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	1.000	0.0	9	1.000	0.0	9	1.000	0.0	-	0.000	0.0
10	0.137	15.3	12	1.965	-25.2	-	0.000	0.0	1	0.078	180.0
NF 9	23.293	-149.6	9	21.161	71.1	9	20.445	144.0	9	127.630	324.0

TABLE 19 MODAL PARAMETERS FOR CONFIGURATION 3(b) AT 0 RPM

MODE= 1F, RPM= 0, FREQUENCY= 5.17 HZ (BLADE 8), 5.39 HZ (BLADE 5), DAMPING= 0.64 %

	RECORD NO. 766 MUX 1 (BLD 8)			RECORD NO. 767 MUX 2 (BLD 8)			RECORD NO. 768 MUX 3 (BLD 8)			RECORD NO. 768 MUX 3 (BLD 5)		
	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
	1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
	2	0.000	0.0	11	0.040	180.0	-	0.000	0.0	-	0.000	0.0
	3	0.364	0.0	13	0.050	180.0	-	0.000	0.0	5	0.595	-138.1
	4	0.131	0.0	14	0.055	0.0	-	0.000	0.0	8	2.807	180.0
	5	0.095	128.5	5	0.138	180.0	5	0.133	180.0	-	0.000	0.0
	6	0.045	180.0	15	0.038	-113.2	-	0.000	0.0	9	0.000	0.0
	7	0.000	0.0	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
	8	0.889	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
	9	0.397	0.0	9	0.000	0.0	9	0.400	0.0	-	0.000	0.0
	10	0.000	0.0	12	0.000	0.0	-	0.000	0.0	1	0.000	0.0
NF	1	24.337	-44.8	1	22.032	75.9	1	26.895	5.0		1.000	0.0

MODE= 2F, RPM= 0, FREQUENCY= 32.22 HZ (BLADE 8), 32.96 HZ (BLADE 5), DAMPING= 0.66 %

	RECORD NO. 760 MUX 1 (BLD 8)			RECORD NO. 761 MUX 2 (BLD 8)			RECORD NO. 762 MUX 3 (BLD 8)			RECORD NO. 762 MUX 3 (BLD 5)		
	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
	1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
	2	0.000	0.0	11	0.065	180.0	-	0.000	0.0	-	0.000	0.0
	3	0.893	180.0	13	0.094	98.7	-	0.000	0.0	5	0.211	163.3
	4	0.647	180.0	14	0.311	180.0	-	0.000	0.0	8	1.052	0.0
	5	0.275	180.0	5	0.263	180.0	5	0.304	180.0	-	0.000	0.0
	6	0.056	-123.0	15	0.000	0.0	-	0.000	0.0	9	0.000	0.0
	7	0.000	0.0	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
	8	0.000	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
	9	0.296	0.0	9	0.285	0.0	9	0.273	0.0	-	0.000	0.0
	10	0.000	0.0	12	0.424	180.0	-	0.000	0.0	1	1.000	0.0
NF	1	14.725	84.7	1	14.889	-112.7	1	14.917	82.1	1	4.664	6.3

MODE= 3F, RPM= 0, FREQUENCY= 90.62 HZ (BLADE 8), 90.74 HZ (BLADE 5), DAMPING= 0.88 %

	RECORD NO. 757 MUX 1 (BLD 8)			RECORD NO. 758 MUX 2 (BLD 8)			RECORD NO. 759 MUX 3 (BLD 8)			RECORD NO. 759 MUX 3 (BLD 5)		
	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
	1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
	2	0.000	0.0	11	0.319	52.7	-	0.000	0.0	-	0.000	0.0
	3	0.000	0.0	13	0.166	0.0	-	0.000	0.0	5	0.623	180.0
	4	1.235	0.0	14	0.805	0.0	-	0.000	0.0	8	4.104	25.0
	5	0.122	-126.7	5	0.000	0.0	5	0.133	0.0	-	0.000	0.0
	6	0.111	180.0	15	0.000	0.0	-	0.000	0.0	9	0.000	0.0
	7	0.000	0.0	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
	8	0.000	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
	9	0.343	0.0	9	0.353	0.0	9	0.000	0.0	-	0.000	0.0
	10	0.000	0.0	12	0.000	0.0	-	0.000	0.0	1	0.000	0.0
NF	1	4.408	82.7	1	4.445	102.1	1	4.259	-3.7		1.000	0.0

MODE= 1E, RPM= 0, FREQUENCY= 23.63 HZ (BLADE 8), 23.65 HZ (BLADE 5), DAMPING= 0.66 %

	RECORD NO. 754 MUX 1 (BLD 8)			RECORD NO. 755 MUX 2 (BLD 8)			RECORD NO. 756 MUX 3 (BLD 8)			RECORD NO. 756 MUX 3 (BLD 5)		
	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
	1	0.000	0.0	1	0.024	0.0	1	0.000	0.0	-	0.000	0.0
	2	0.000	0.0	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
	3	0.000	0.0	13	0.038	180.0	-	0.000	0.0	5	1.000	0.0
	4	0.000	0.0	14	0.000	0.0	-	0.000	0.0	8	0.150	0.0
	5	1.000	0.0	5	1.000	0.0	5	1.000	0.0	-	0.000	0.0
	6	0.661	0.0	15	0.000	0.0	-	0.000	0.0	9	0.111	0.0
	7	0.000	0.0	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
	8	0.203	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
	9	0.137	0.0	9	0.138	0.0	9	0.135	0.0	-	0.000	0.0
	10	0.076	180.0	12	0.000	0.0	-	0.000	0.0	1	0.000	0.0
NF	5	96.217	-139.4	5	96.296	152.7	5	97.507	66.3	5	80.939	246.3

MODE= 1T, RPM= 0, FREQUENCY= 43.95 HZ (BLADE 8), 44.16 HZ (BLADE 5), DAMPING= 0.56 %

	RECORD NO. 751 MUX 1 (BLD 8)			RECORD NO. 752 MUX 2 (BLD 8)			RECORD NO. 753 MUX 3 (BLD 8)			RECORD NO. 753 MUX 3 (BLD 5)		
	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
	1	0.021	0.0	1	0.000	0.0	1	0.000	0.0	-	0.000	0.0
	2	0.000	0.0	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
	3	0.000	0.0	13	0.092	0.0	-	0.000	0.0	5	2.317	-10.7
	4	0.000	0.0	14	0.026	180.0	-	0.000	0.0	8	0.651	-13.3
	5	0.199	180.0	5	0.279	138.2	5	0.198	180.0	-	0.000	0.0
	6	0.000	0.0	15	0.337	0.0	-	0.000	0.0	9	0.000	0.0
	7	0.000	0.0	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
	8	0.000	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
	9	1.000	0.0	9	1.000	0.0	9	1.000	0.0	-	0.000	0.0
	10	0.000	0.0	12	1.147	0.0	-	0.000	0.0	1	0.000	0.0
NF	9	27.112	0.1	9	26.329	-77.7	9	27.507	75.1		1.000	0.0

TABLE 20 MODAL PARAMETERS FOR CONFIGURATION 3(b) AT 1000 RPM

MODE= 1F, RPM= 1000, FREQUENCY= 18.71 HZ (BLADE 8), 18.71 HZ (BLADE 5), DAMPING= 0.51 %

RECORD NO. 736 MUX 1 (BLD 8)			RECORD NO. 737 MUX 2 (BLD 8)			RECORD NO. 738 MUX 3 (BLD 8)			RECORD NO. 738 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.000	0.0	11	0.077	29.3	-	0.000	0.0	-	0.000	0.0
3	0.050	0.0	13	0.058	180.0	-	0.000	0.0	5	1.216	0.0
4	0.021	-93.8	14	0.025	0.0	-	0.000	0.0	8	1.282	0.0
5	1.195	-11.7	5	1.147	-12.9	5	1.117	-17.7	-	0.000	0.0
6	0.730	-10.8	15	0.000	0.0	-	0.000	0.0	9	0.504	0.0
7	0.000	0.0	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
8	1.097	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.679	0.0	9	0.679	0.0	9	0.651	0.0	-	0.000	0.0
10	0.163	180.0	12	0.070	0.0	-	0.000	0.0	1	1.000	0.0
NF 1	18.136	-24.0	1	25.976	165.3	1	15.234	126.8	1	10.227	306.8

MODE= 2F, RPM= 1000, FREQUENCY= 54.62 HZ (BLADE 8), 55.22 HZ (BLADE 5), DAMPING= 0.45 %

RECORD NO. 739 MUX 1 (BLD 8)			RECORD NO. 740 MUX 2 (BLD 8)			RECORD NO. 741 MUX 3 (BLD 8)			RECORD NO. 741 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.000	0.0	11	0.315	-83.9	-	0.000	0.0	-	0.000	0.0
3	0.843	180.0	13	0.413	-107.2	-	0.000	0.0	5	3.326	-140.1
4	0.778	180.0	14	0.449	180.0	-	0.000	0.0	8	1.031	0.0
5	5.456	180.0	5	5.747	58.9	5	5.010	180.0	-	0.000	0.0
6	3.772	180.0	15	1.439	-126.4	-	0.000	0.0	9	12.921	0.0
7	0.000	0.0	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
8	0.908	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	1.667	-41.9	9	1.676	-115.4	9	1.501	146.7	-	0.000	0.0
10	0.309	-74.4	12	3.939	-120.8	-	0.000	0.0	1	1.000	0.0
NF 1	9.088	107.6	1	10.634	36.6	1	5.678	-155.5	1	4.480	24.5

MODE= 3F, RPM= 1000, FREQUENCY=117.04 HZ (BLADE 8), 116.22 HZ (BLADE 5), DAMPING= 0.39 %

RECORD NO. 742 MUX 1 (BLD 8)			RECORD NO. 743 MUX 2 (BLD 8)			RECORD NO. 744 MUX 3 (BLD 8)			RECORD NO. 744 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.000	0.0	11	0.252	180.0	-	0.000	0.0	-	0.000	0.0
3	0.205	180.0	13	0.198	0.0	-	0.000	0.0	5	0.562	180.0
4	1.395	0.0	14	1.182	0.0	-	0.000	0.0	8	1.089	0.0
5	0.251	39.0	5	0.174	-142.6	5	0.188	87.3	-	0.000	0.0
6	0.440	-57.7	15	0.705	0.0	-	0.000	0.0	9	0.713	-41.5
7	0.000	0.0	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
8	0.874	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.323	-28.1	9	0.377	0.0	9	0.256	-22.9	-	0.000	0.0
10	0.172	-114.6	12	0.416	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	9.525	82.7	1	9.060	-162.6	1	12.108	-31.0	1	3.954	-97.0

MODE= 1E, RPM= 1000, FREQUENCY= 24.79 HZ (BLADE 8), 24.80 HZ (BLADE 5), DAMPING= 0.91 %

RECORD NO. 745 MUX 1 (BLD 8)			RECORD NO. 746 MUX 2 (BLD 8)			RECORD NO. 747 MUX 3 (BLD 8)			RECORD NO. 747 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.000	0.0	1	0.000	0.0	1	0.000	0.0	-	0.000	0.0
2	0.000	0.0	11	0.027	133.5	-	0.000	0.0	-	0.000	0.0
3	0.000	0.0	13	0.023	-71.3	-	0.000	0.0	5	1.000	0.0
4	0.000	0.0	14	0.000	0.0	-	0.000	0.0	8	0.134	180.0
5	1.000	0.0	5	1.000	0.0	5	1.000	0.0	-	0.000	0.0
6	0.572	0.0	15	0.000	0.0	-	0.000	0.0	9	0.251	0.0
7	0.000	0.0	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
8	0.173	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.255	0.0	9	0.249	0.0	9	0.248	0.0	-	0.000	0.0
10	0.036	180.0	12	0.000	0.0	-	0.000	0.0	1	0.030	-144.9
NF 5	93.285	76.5	5	90.014	52.7	5	89.826	37.7	5	65.989	217.7

MODE= 1T, RPM= 1000, FREQUENCY= 50.27 HZ (BLADE 8), 50.33 HZ (BLADE 5), DAMPING=-0.15 %

RECORD NO. 748 MUX 1 (BLD 8)			RECORD NO. 749 MUX 2 (BLD 8)			RECORD NO. 750 MUX 3 (BLD 8)			RECORD NO. 750 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.224	-159.1	1	0.229	-153.7	1	0.212	-160.9	-	0.000	0.0
2	0.000	0.0	11	0.095	-162.0	-	0.000	0.0	-	0.000	0.0
3	0.096	64.5	13	0.202	0.0	-	0.000	0.0	5	0.232	180.0
4	0.081	49.8	14	0.106	180.0	-	0.000	0.0	8	0.052	180.0
5	3.235	180.0	5	3.137	180.0	5	3.218	180.0	-	0.000	0.0
6	2.211	180.0	15	0.771	0.0	-	0.000	0.0	9	1.000	0.0
7	0.000	0.0	16	0.057	180.0	-	0.000	0.0	10	0.000	0.0
8	0.000	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	1.000	0.0	9	1.000	0.0	9	1.000	0.0	-	0.000	0.0
10	0.168	0.0	12	2.022	0.0	-	0.000	0.0	1	0.031	180.0
NF 9	6.445	45.1	9	5.954	121.7	9	5.937	152.2	9	53.773	332.2

TABLE 21 MODAL PARAMETERS FOR CONFIGURATION 4(a) AT 0 RPM

DATA NOT AVAILABLE

MODE= 2F, RPM= 0, FREQUENCY= 32.17 HZ (BLADE 8), 32.89 HZ (BLADE 5), DAMPING= 0.49 %

RECORD NO. 641 MUX 1 (BLD 8)			RECORD NO. 642 MUX 2 (BLD 8)			RECORD NO. 643 MUX 3 (BLD 8)			RECORD NO. 643 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.213	-32.5	11	1.594	0.0	-	0.000	0.0	-	0.000	0.0
3	0.896	180.0	13	0.092	0.0	-	0.000	0.0	5	0.303	-144.4
4	0.649	180.0	14	0.313	180.0	-	0.000	0.0	8	1.039	0.0
5	0.194	180.0	5	0.200	108.3	5	0.195	180.0	-	0.000	0.0
6	0.000	0.0	15	0.189	180.0	-	0.000	0.0	9	0.121	180.0
7	0.056	0.0	16	0.047	0.0	-	0.000	0.0	10	0.240	-167.7
8	0.837	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.260	0.0	9	0.263	0.0	9	0.262	0.0	-	0.000	0.0
10	0.112	180.0	12	0.383	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	9.537	114.2	1	9.304	-10.5	1	9.316	-52.2	1	1.868	127.8

MODE= 3F, RPM= 0, FREQUENCY= 90.69 HZ (BLADE 8), 89.30 HZ (BLADE 5), DAMPING= 1.04 %

RECORD NO. 644 MUX 1 (BLD 8)			RECORD NO. 645 MUX 2 (BLD 8)			RECORD NO. 646 MUX 3 (BLD 8)			RECORD NO. 646 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	1.477	180.0	11	7.791	20.9	-	0.000	0.0	-	0.000	0.0
3	0.104	180.0	13	0.169	0.0	-	0.000	0.0	5	0.221	180.0
4	1.261	0.0	14	0.649	0.0	-	0.000	0.0	8	1.086	0.0
5	0.135	180.0	5	0.174	180.0	5	0.114	-54.3	-	0.000	0.0
6	0.061	60.9	15	0.369	0.0	-	0.000	0.0	9	0.258	0.0
7	0.060	180.0	16	0.135	180.0	-	0.000	0.0	10	0.236	180.0
8	0.848	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.283	-17.7	9	0.273	0.0	9	0.345	0.0	-	0.000	0.0
10	0.138	-159.3	12	0.509	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	1.782	133.3	1	1.773	-85.6	1	1.715	93.9	1	1.863	273.9

MODE= 1E, RPM= 0, FREQUENCY= 21.91 HZ (BLADE 8), 22.00 HZ (BLADE 5), DAMPING= 0.63 %

RECORD NO. 647 MUX 1 (BLD 8)			RECORD NO. 648 MUX 2 (BLD 8)			RECORD NO. 649 MUX 3 (BLD 8)			RECORD NO. 649 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.000	0.0	1	0.000	0.0	1	0.000	0.0	-	0.000	0.0
2	0.000	0.0	11	0.153	40.9	-	0.000	0.0	-	0.000	0.0
3	0.000	0.0	13	0.034	180.0	-	0.000	0.0	5	1.000	0.0
4	0.000	0.0	14	0.000	0.0	-	0.000	0.0	8	0.151	0.0
5	1.000	0.0	5	1.000	0.0	5	1.000	0.0	-	0.000	0.0
6	0.664	0.0	15	0.000	0.0	-	0.000	0.0	9	0.104	0.0
7	0.526	0.0	16	0.000	0.0	-	0.000	0.0	10	0.078	180.0
8	0.198	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.138	0.0	9	0.138	0.0	9	0.138	0.0	-	0.000	0.0
10	0.077	180.0	12	0.028	0.0	-	0.000	0.0	1	0.000	0.0
NF 5	86.696	41.6	5	87.163	11.1	5	89.066	64.3	5	73.918	244.3

MODE= 1T, RPM= 0, FREQUENCY= 39.01 HZ (BLADE 8), 41.65 HZ (BLADE 5), DAMPING= 0.97 %

RECORD NO. 650 MUX 1 (BLD 8)			RECORD NO. 651 MUX 2 (BLD 8)			RECORD NO. 652 MUX 3 (BLD 8)			RECORD NO. 652 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.043	25.1	1	0.043	11.9	1	0.047	16.8	-	0.000	0.0
2	0.067	105.2	11	1.350	138.4	-	0.000	0.0	-	0.000	0.0
3	0.065	180.0	13	0.072	180.0	-	0.000	0.0	5	1.102	-33.4
4	0.037	180.0	14	0.034	71.1	-	0.000	0.0	8	0.388	-57.0
5	0.293	180.0	5	0.302	180.0	5	0.293	70.1	-	0.000	0.0
6	0.147	180.0	15	0.312	0.0	-	0.000	0.0	9	1.000	0.0
7	0.062	180.0	16	0.024	27.9	-	0.000	0.0	10	0.000	0.0
8	0.193	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	1.000	0.0	9	1.000	0.0	9	1.000	0.0	-	0.000	0.0
10	0.038	-99.6	12	0.957	0.0	-	0.000	0.0	1	0.272	-59.3
NF 9	8.132	-99.4	9	8.026	-155.9	9	8.041	-9.1	9	0.751	36.1

TABLE 22 MODAL PARAMETERS FOR CONFIGURATION 4(a) AT 1000 RPM

MODE= 1F, RPM= 1000, FREQUENCY= 19.33 HZ (BLADE 8), 19.49 HZ (BLADE 5), DAMPING=-0.01 %

RECORD NO. 666 MUX 1 (BLD 8)			RECORD NO. 667 MUX 2 (BLD 8)			RECORD NO. 666 MUX 3 (BLD 8)			RECORD NO. 668 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.313	0.0	11	0.130	-19.7	-	0.000	0.0	-	0.000	0.0
3	0.064	0.0	13	0.026	154.5	-	0.000	0.0	5	0.940	0.0
4	0.028	0.0	14	0.000	0.0	-	0.000	0.0	8	1.054	0.0
5	0.379	-71.1	5	0.436	125.6	5	2.627	-123.6	-	0.000	0.0
6	0.231	-60.0	15	0.000	0.0	-	0.000	0.0	9	0.253	0.0
7	0.175	-58.9	16	0.000	0.0	-	0.000	0.0	10	0.238	180.0
8	0.911	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.464	-10.6	9	0.469	-10.6	9	0.438	-93.5	-	0.000	0.0
10	0.122	180.0	12	0.057	0.0	-	0.000	0.0	1	1.000	0.0
NF 1	32.021	1.5	1	25.184	-113.3	1	3.640	170.0	1	6.317	350.0

MODE= 2F, RPM= 1000, FREQUENCY= 54.83 HZ (BLADE 8), 54.42 HZ (BLADE 5), DAMPING= 0.54 %

RECORD NO. 663 MUX 1 (BLD 8)			RECORD NO. 664 MUX 2 (BLD 8)			RECORD NO. 665 MUX 3 (BLD 8)			RECORD NO. 665 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.000	0.0	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.876	180.0	13	0.125	0.0	-	0.000	0.0	5	2.916	-92.0
4	0.816	180.0	14	0.445	180.0	-	0.000	0.0	8	1.025	-59.2
5	2.244	180.0	5	2.887	58.7	5	2.954	103.7	-	0.000	0.0
6	1.641	180.0	15	0.625	180.0	-	0.000	0.0	9	1.484	24.8
7	1.367	180.0	16	0.111	23.3	-	0.000	0.0	10	0.242	180.0
8	0.879	-11.1	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.610	0.0	9	0.537	75.9	9	0.637	180.0	-	0.000	0.0
10	0.099	180.0	12	1.614	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	8.246	-143.8	1	10.744	-127.6	1	10.271	-124.8	1	12.986	30.3

MODE= 3F, RPM= 1000, FREQUENCY=116.91 HZ (BLADE 8), 117.03 HZ (BLADE 5), DAMPING= 0.03 %

RECORD NO. 659 MUX 1 (BLD 8)			RECORD NO. 661 MUX 2 (BLD 8)			RECORD NO. 662 MUX 3 (BLD 8)			RECORD NO. 662 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.000	0.0	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.000	0.0	13	0.160	0.0	-	0.000	0.0	5	0.262	-146.0
4	1.453	0.0	14	1.156	0.0	-	0.000	0.0	8	1.055	0.0
5	0.360	180.0	5	0.273	180.0	5	0.361	137.3	-	0.000	0.0
6	0.601	56.8	15	0.498	0.0	-	0.000	0.0	9	0.149	23.9
7	0.722	61.4	16	0.286	180.0	-	0.000	0.0	10	0.223	180.0
8	0.781	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.350	31.4	9	0.404	-13.2	9	0.468	0.0	-	0.000	0.0
10	0.135	180.0	12	0.502	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	8.285	-148.6	1	11.927	110.5	1	14.777	-109.0	1	14.342	37.0

MODE= 1E, RPM= 1000, FREQUENCY= 21.35 HZ (BLADE 8), 21.33 HZ (BLADE 5), DAMPING= 0.97 %

RECORD NO. 656 MUX 1 (BLD 8)			RECORD NO. 657 MUX 2 (BLD 8)			RECORD NO. 658 MUX 3 (BLD 8)			RECORD NO. 658 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.031	180.0	1	0.032	180.0	1	0.030	-132.9	-	0.000	0.0
2	0.000	0.0	11	0.074	0.0	-	0.000	0.0	-	0.000	0.0
3	0.000	0.0	13	0.030	180.0	-	0.000	0.0	5	1.000	0.0
4	0.000	0.0	14	0.000	0.0	-	0.000	0.0	8	0.161	0.0
5	1.000	0.0	5	1.000	0.0	5	1.000	0.0	-	0.000	0.0
6	0.556	0.0	15	0.000	0.0	-	0.000	0.0	9	0.222	0.0
7	0.426	0.0	16	0.000	0.0	-	0.000	0.0	10	0.060	180.0
8	0.152	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.207	0.0	9	0.207	0.0	9	0.206	0.0	-	0.000	0.0
10	0.037	180.0	12	0.000	0.0	-	0.000	0.0	1	0.035	-95.0
NF 5	101.949	-124.7	5	102.801	-175.0	5	112.515	8.5	5	83.433	188.5

MODE= 1T, RPM= 1000, FREQUENCY= 38.66 HZ (BLADE 8), 38.65 HZ (BLADE 5), DAMPING= 1.21 %

RECORD NO. 653 MUX 1 (BLD 8)			RECORD NO. 654 MUX 2 (BLD 8)			RECORD NO. 655 MUX 3 (BLD 8)			RECORD NO. 655 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.000	0.0	1	0.027	-36.4	1	0.000	0.0	-	0.000	0.0
2	0.027	38.3	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.000	0.0	13	0.033	180.0	-	0.000	0.0	5	2.144	0.0
4	0.000	0.0	14	0.000	0.0	-	0.000	0.0	8	0.319	-12.0
5	1.648	0.0	5	1.849	0.0	5	1.844	0.0	-	0.000	0.0
6	1.050	0.0	15	0.129	14.8	-	0.000	0.0	9	1.000	0.0
7	0.877	0.0	16	0.000	0.0	-	0.000	0.0	10	0.149	180.0
8	0.387	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	1.000	0.0	9	1.000	0.0	9	1.000	0.0	-	0.000	0.0
10	0.044	180.0	12	0.539	0.0	-	0.000	0.0	1	0.000	0.0
NF 9	25.282	-44.2	9	25.994	-164.1	9	24.263	-30.5	9	17.297	-30.5

TABLE 23 MODAL PARAMETERS FOR CONFIGURATION 4(b) AT 0 RPM

MODE= 1F, RPM= 0, FREQUENCY= 5.18 HZ (BLADE 8), 5.34 HZ (BLADE 5), DAMPING= 0.68 %

RECORD NO. 670 MUX 1 (BLD 8)			RECORD NO. 671 MUX 2 (BLD 8)			RECORD NO. 672 MUX 3 (BLD 8)			RECORD NO. 672 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.764	0.0	11	0.543	0.0	-	0.000	0.0	-	0.000	0.0
3	0.377	0.0	13	0.094	-82.3	-	0.000	0.0	5	0.218	-99.6
4	0.127	0.0	14	0.074	180.0	-	0.000	0.0	8	0.990	0.0
5	0.124	180.0	5	0.155	180.0	5	0.443	180.0	-	0.000	0.0
6	0.051	180.0	15	0.035	180.0	-	0.000	0.0	9	0.191	0.0
7	0.000	0.0	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
8	0.000	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.399	0.0	9	0.262	180.0	9	0.589	180.0	-	0.000	0.0
10	0.000	0.0	12	0.165	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	10.781	142.7	1	14.712	-148.0	1	6.523	-163.4	1	6.558	16.6

MODE= 2F, RPM= 0, FREQUENCY= 32.16 HZ (BLADE 8), 32.70 HZ (BLADE 5), DAMPING= 0.47 %

RECORD NO. 673 MUX 1 (BLD 8)			RECORD NO. 674 MUX 2 (BLD 8)			RECORD NO. 675 MUX 3 (BLD 8)			RECORD NO. 675 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.034	-87.6	11	0.653	180.0	-	0.000	0.0	-	0.000	0.0
3	0.894	180.0	13	0.107	0.0	-	0.000	0.0	5	0.206	-121.1
4	0.649	180.0	14	0.342	180.0	-	0.000	0.0	8	1.046	0.0
5	0.230	180.0	5	0.260	180.0	5	0.210	168.3	-	0.000	0.0
6	0.027	63.6	15	0.207	180.0	-	0.000	0.0	9	0.144	-22.6
7	0.037	29.2	16	0.000	0.0	-	0.000	0.0	10	0.224	180.0
8	0.825	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.232	0.0	9	0.224	180.0	9	0.233	0.0	-	0.000	0.0
10	0.107	180.0	12	0.415	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	9.120	-69.8	1	9.104	-152.2	1	9.046	-29.3	1	2.694	91.8

MODE= 3F, RPM= 0, FREQUENCY= 90.32 HZ (BLADE 8), 89.29 HZ (BLADE 5), DAMPING= 1.58 %

RECORD NO. 676 MUX 1 (BLD 8)			RECORD NO. 677 MUX 2 (BLD 8)			RECORD NO. 679 MUX 3 (BLD 8)			RECORD NO. 679 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.737	-130.5	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.095	-95.7	13	0.216	131.1	-	0.000	0.0	5	0.204	180.0
4	1.248	0.0	14	0.834	0.0	-	0.000	0.0	8	1.134	0.0
5	0.875	-122.3	5	0.407	-63.1	5	0.710	180.0	-	0.000	0.0
6	0.112	180.0	15	0.417	-12.9	-	0.000	0.0	9	0.275	180.0
7	0.000	0.0	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
8	0.000	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.168	90.8	9	0.343	10.7	9	0.367	69.0	-	0.000	0.0
10	0.000	0.0	12	0.442	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	4.069	73.7	1	4.161	94.2	1	3.917	67.6	1	5.207	-93.4

MODE= 1E, RPM= 0, FREQUENCY= 21.83 HZ (BLADE 8), 21.76 HZ (BLADE 5), DAMPING= 0.42 %

RECORD NO. 680 MUX 1 (BLD 8)			RECORD NO. 681 MUX 2 (BLD 8)			RECORD NO. 682 MUX 3 (BLD 8)			RECORD NO. 682 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.000	0.0	1	0.020	0.0	1	0.021	0.0	-	0.000	0.0
2	0.000	0.0	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.000	0.0	13	0.038	180.0	-	0.000	0.0	5	1.000	0.0
4	0.000	0.0	14	0.000	0.0	-	0.000	0.0	8	0.152	0.0
5	1.000	0.0	5	1.000	0.0	5	1.000	0.0	-	0.000	0.0
6	0.703	0.0	15	0.000	0.0	-	0.000	0.0	9	0.104	0.0
7	0.555	0.0	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
8	0.213	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.149	0.0	9	0.157	0.0	9	0.164	0.0	-	0.000	0.0
10	0.082	180.0	12	0.035	0.0	-	0.000	0.0	1	0.023	180.0
NF 5	58.941	176.2	5	55.009	88.3	5	53.093	37.4	5	50.833	217.4

MODE= 1T, RPM= 0, FREQUENCY= 37.89 HZ (BLADE 8), 42.27 HZ (BLADE 5), DAMPING= 0.43 %

RECORD NO. 683 MUX 1 (BLD 8)			RECORD NO. 685 MUX 2 (BLD 8)			RECORD NO. 686 MUX 3 (BLD 8)			RECORD NO. 686 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.064	0.0	1	0.080	0.0	1	0.071	-98.2	-	0.000	0.0
2	0.027	180.0	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.094	180.0	13	0.080	-103.2	-	0.000	0.0	5	3.176	-40.9
4	0.000	0.0	14	0.064	82.8	-	0.000	0.0	8	1.068	31.5
5	0.337	180.0	5	0.398	85.2	5	0.369	149.9	-	0.000	0.0
6	0.160	180.0	15	0.302	0.0	-	0.000	0.0	9	1.000	0.0
7	0.000	0.0	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
8	0.000	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	1.000	0.0	9	1.000	0.0	9	1.000	0.0	-	0.000	0.0
10	0.000	0.0	12	0.924	0.0	-	0.000	0.0	1	0.000	0.0
NF 9	10.614	92.7	9	9.478	29.4	9	9.020	-48.6	9	0.331	-92.0

TABLE 24 MODAL PARAMETERS FOR CONFIGURATION 4(b) AT 920/1000 RPM

MODE= 1F, RPM= 1000, FREQUENCY= 18.42 HZ (BLADE 8), 18.40 HZ (BLADE 5), DAMPING= 0.10 %

RECORD NO. 698 MUX 1 (BLD 8)			RECORD NO. 699 MUX 2 (BLD 8)			RECORD NO. 700 MUX 3 (BLD 8)			RECORD NO. 700 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.290	0.0	11	9.645	-163.5	-	0.000	0.0	-	0.000	0.0
3	0.053	0.0	13	0.068	180.0	-	0.000	0.0	5	1.823	180.0
4	0.023	0.0	14	0.029	-12.5	-	0.000	0.0	8	1.381	0.0
5	1.922	0.0	5	1.735	-15.1	5	1.685	-16.8	-	0.000	0.0
6	1.146	0.0	15	0.026	180.0	-	0.000	0.0	9	0.652	0.0
7	0.000	0.0	16	0.037	180.0	-	0.000	0.0	10	0.000	0.0
8	1.214	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.833	0.0	9	0.796	0.0	9	0.772	0.0	-	0.000	0.0
10	0.214	180.0	12	0.060	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	21.552	146.1	1	17.571	128.6	1	17.181	0.3	1	12.057	169.6

MODE= 2F, RPM= 1000, FREQUENCY= 52.64 HZ (BLADE 8), 55.02 HZ (BLADE 5), DAMPING= 0.39 %

RECORD NO. 693 MUX 1 (BLD 8)			RECORD NO. 696 MUX 2 (BLD 8)			RECORD NO. 697 MUX 3 (BLD 8)			RECORD NO. 697 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.185	180.0	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.987	180.0	13	0.204	180.0	-	0.000	0.0	5	5.496	180.0
4	0.854	180.0	14	0.421	180.0	-	0.000	0.0	8	1.148	180.0
5	8.468	13.3	5	6.261	70.8	5	5.381	-130.2	-	0.000	0.0
6	5.908	15.7	15	1.382	180.0	-	0.000	0.0	9	2.384	-155.6
7	0.000	0.0	16	0.123	0.0	-	0.000	0.0	10	0.000	0.0
8	1.531	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	1.719	180.0	9	1.395	180.0	9	1.213	-13.8	-	0.000	0.0
10	0.542	180.0	12	3.141	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	2.726	-162.2	1	8.073	158.5	1	5.317	100.9	1	5.115	280.9

MODE= 3F, RPM= 920, FREQUENCY=110.74 HZ (BLADE 8), 109.85 HZ (BLADE 5), DAMPING= 0.86 %

RECORD NO. 701 MUX 1 (BLD 8)			RECORD NO. 702 MUX 2 (BLD 8)			RECORD NO. 703 MUX 3 (BLD 8)			RECORD NO. 703 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.887	180.0	11	111.019	-159.3	-	0.000	0.0	-	0.000	0.0
3	0.169	27.9	13	0.374	180.0	-	0.000	0.0	5	0.696	-169.4
4	1.688	0.0	14	1.171	-12.0	-	0.000	0.0	8	1.310	13.1
5	0.791	180.0	5	0.939	180.0	5	1.124	-56.1	-	0.000	0.0
6	2.542	180.0	15	1.122	0.0	-	0.000	0.0	9	0.974	92.3
7	3.267	180.0	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
8	0.876	-13.1	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.858	180.0	9	0.900	32.1	9	0.936	-116.7	-	0.000	0.0
10	0.203	162.5	12	1.032	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	12.086	-139.9	1	8.610	139.3	1	2.569	-58.7	1	1.320	10.6

MODE= 1E, RPM= 1000, FREQUENCY= 21.99 HZ (BLADE 8), 22.03 HZ (BLADE 5), DAMPING= 0.26 %

RECORD NO. 690 MUX 1 (BLD 8)			RECORD NO. 691 MUX 2 (BLD 8)			RECORD NO. 692 MUX 3 (BLD 8)			RECORD NO. 692 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.109	180.0	1	0.108	180.0	1	0.110	180.0	-	0.000	0.0
2	0.051	180.0	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.000	0.0	13	0.033	180.0	-	0.000	0.0	5	1.000	0.0
4	0.000	0.0	14	0.000	0.0	-	0.000	0.0	8	0.057	-26.3
5	1.000	0.0	5	1.000	0.0	5	1.000	0.0	-	0.000	0.0
6	0.731	0.0	15	0.000	0.0	-	0.000	0.0	9	0.232	-10.5
7	0.000	0.0	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
8	0.137	180.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.281	180.0	9	0.286	0.0	9	0.290	-10.9	-	0.000	0.0
10	0.042	156.5	12	0.000	0.0	-	0.000	0.0	1	0.102	180.0
NF 5	60.154	-139.6	5	58.724	-1.7	5	60.906	25.9	5	60.942	205.9

MODE= 1T, RPM= 1000, FREQUENCY= 38.10 HZ (BLADE 8), 37.77 HZ (BLADE 5), DAMPING= 1.03 %

RECORD NO. 687 MUX 1 (BLD 8)			RECORD NO. 688 MUX 2 (BLD 8)			RECORD NO. 689 MUX 3 (BLD 8)			RECORD NO. 689 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.000	0.0	1	0.057	180.0	1	0.053	17.9	-	0.000	0.0
2	0.030	152.8	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.032	-26.0	13	0.044	-116.2	-	0.000	0.0	5	1.936	0.0
4	0.036	-28.1	14	0.041	0.0	-	0.000	0.0	8	0.336	18.3
5	1.311	0.0	5	2.219	180.0	5	1.456	0.0	-	0.000	0.0
6	0.884	0.0	15	0.217	-72.5	-	0.000	0.0	9	1.000	0.0
7	0.000	0.0	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
8	0.403	121.5	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	1.000	0.0	9	1.000	0.0	9	1.000	0.0	-	0.000	0.0
10	0.067	-35.2	12	0.884	-62.5	-	0.000	0.0	1	0.044	-21.2
NF 9	21.175	29.9	9	22.252	120.2	9	20.299	20.2	9	14.737	20.2

TABLE 25 MODAL PARAMETERS FOR CONFIGURATION 5(a) AT 0 RPM

MODE= 1F, RPM= 0, FREQUENCY= 5.21 HZ (BLADE 8), 5.21 HZ (BLADE 5), DAMPING= 0.58 %

RECORD NO. 401 MUX 1 (BLD 8)			RECORD NO. 402 MUX 2 (BLD 8)			RECORD NO. 403 MUX 3 (BLD 8)			RECORD NO. 403 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.727	0.0	11	0.459	0.0	-	0.000	0.0	-	0.000	0.0
3	0.365	0.0	13	0.000	0.0	-	0.000	0.0	5	0.000	0.0
4	0.131	0.0	14	0.053	0.0	-	0.000	0.0	8	0.000	0.0
5	0.000	0.0	5	0.076	180.0	5	0.119	180.0	-	0.000	0.0
6	0.045	180.0	15	0.000	0.0	-	0.000	0.0	9	0.000	0.0
7	0.044	180.0	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
8	0.862	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.387	0.0	9	0.396	0.0	9	0.396	0.0	-	0.000	0.0
10	0.088	180.0	12	0.000	0.0	-	0.000	0.0	1	1.000	0.0
NF 1	81.144	147.9	1	56.619	59.7	1	57.082	-76.8	1	2.382	103.2

MODE= 2F, RPM= 0, FREQUENCY= 32.36 HZ (BLADE 8), 32.23 HZ (BLADE 5), DAMPING= 0.55 %

RECORD NO. 404 MUX 1 (BLD 8)			RECORD NO. 405 MUX 2 (BLD 8)			RECORD NO. 406 MUX 3 (BLD 8)			RECORD NO. 406 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.113	0.0	11	0.584	180.0	-	0.000	0.0	-	0.000	0.0
3	0.881	180.0	13	0.096	0.0	-	0.000	0.0	5	0.428	169.2
4	0.641	180.0	14	0.308	180.0	-	0.000	0.0	8	1.385	-37.0
5	0.235	180.0	5	0.235	180.0	5	0.234	180.0	-	0.000	0.0
6	0.027	-87.6	15	0.178	180.0	-	0.000	0.0	9	0.000	0.0
7	0.034	0.0	16	0.046	0.0	-	0.000	0.0	10	0.290	180.0
8	0.817	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.292	0.0	9	0.290	0.0	9	0.290	0.0	-	0.000	0.0
10	0.093	180.0	12	0.330	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	40.980	33.4	1	41.261	-96.3	1	41.307	104.9	1	4.724	-18.5

MODE= 3F, RPM= 0, FREQUENCY= 91.31 HZ (BLADE 8), 90.82 HZ (BLADE 5), DAMPING= 0.66 %

RECORD NO. 407 MUX 1 (BLD 8)			RECORD NO. 408 MUX 2 (BLD 8)			RECORD NO. 409 MUX 3 (BLD 8)			RECORD NO. 409 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.544	180.0	11	0.820	180.0	-	0.000	0.0	-	0.000	0.0
3	0.123	180.0	13	0.174	0.0	-	0.000	0.0	5	0.218	150.4
4	1.202	0.0	14	0.787	0.0	-	0.000	0.0	8	1.054	0.0
5	0.098	-166.4	5	0.093	180.0	5	0.088	180.0	-	0.000	0.0
6	0.039	-112.6	15	0.427	0.0	-	0.000	0.0	9	0.222	0.0
7	0.000	0.0	16	0.147	180.0	-	0.000	0.0	10	0.257	150.4
8	0.824	0.0	-	0.005	0.0	-	0.000	0.0	-	0.000	0.0
9	0.313	0.0	9	0.311	0.0	9	0.314	0.0	-	0.000	0.0
10	0.114	180.0	12	0.374	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	11.880	-26.3	1	13.105	98.6	1	12.388	-178.9	1	16.181	-149.4

MODE= 1E, RPM= 0, FREQUENCY= 23.91 HZ (BLADE 8), 23.98 HZ (BLADE 5), DAMPING= 0.65 %

RECORD NO. 410 MUX 1 (BLD 8)			RECORD NO. 411 MUX 2 (BLD 8)			RECORD NO. 412 MUX 3 (BLD 8)			RECORD NO. 412 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.000	0.0	1	0.000	0.0	1	0.000	0.0	-	0.000	0.0
2	0.000	0.0	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.000	0.0	13	0.036	180.0	-	0.000	0.0	5	1.000	0.0
4	0.000	0.0	14	0.000	0.0	-	0.000	0.0	8	0.148	0.0
5	1.000	0.0	5	1.000	0.0	5	1.000	0.0	-	0.000	0.0
6	0.673	0.0	15	0.023	180.0	-	0.000	0.0	9	0.094	0.0
7	0.532	0.0	16	0.000	0.0	-	0.000	0.0	10	0.078	180.0
8	0.294	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.129	0.0	9	0.129	0.0	9	0.130	0.0	-	0.000	0.0
10	0.084	180.0	12	0.000	0.0	-	0.000	0.0	1	0.025	180.0
NF 5	95.057	-103.3	5	95.687	-116.5	5	95.395	97.2	5	79.718	277.2

MODE= 1T, RPM= 0, FREQUENCY= 44.24 HZ (BLADE 8), 44.42 HZ (BLADE 5), DAMPING= 0.51 %

RECORD NO. 416 MUX 1 (BLD 8)			RECORD NO. 417 MUX 2 (BLD 8)			RECORD NO. 418 MUX 3 (BLD 8)			RECORD NO. 418 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.000	0.0	1	0.000	0.0	1	0.000	0.0	-	0.000	0.0
2	0.000	0.0	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.000	0.0	13	0.057	0.0	-	0.000	0.0	5	2.146	27.2
4	0.000	0.0	14	0.000	0.0	-	0.000	0.0	8	0.000	0.0
5	0.193	180.0	5	0.201	180.0	5	0.198	180.0	-	0.000	0.0
6	0.082	180.0	15	0.343	0.0	-	0.000	0.0	9	1.000	0.0
7	0.000	0.0	16	0.028	0.0	-	0.000	0.0	10	0.000	0.0
8	0.183	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	1.000	0.0	9	1.000	0.0	9	1.000	0.0	-	0.000	0.0
10	0.034	0.0	12	1.006	0.0	-	0.000	0.0	1	0.000	0.0
NF 9	12.472	124.5	9	12.149	142.1	9	12.500	-65.8	9	0.481	-93.0

TABLE 26 MODAL PARAMETERS FOR CONFIGURATION 5(a) AT 1000 RPM

MODE= 1F, RPM= 1000, FREQUENCY= 19.37 HZ (BLADE 8), 19.38 HZ (BLADE 5), DAMPING= 0.11 %

RECORD NO. 419 MUX 1 (BLD 8)			RECORD NO. 420 MUX 2 (BLD 8)			RECORD NO. 421 MUX 3 (BLD 8)			RECORD NO. 421 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.309	0.0	11	0.111	0.0	-	0.000	0.0	-	0.000	0.0
3	0.063	0.0	13	0.024	160.2	-	0.000	0.0	5	1.180	-11.0
4	0.028	0.0	14	0.025	16.0	-	0.000	0.0	8	1.083	0.0
5	1.167	124.4	5	0.804	91.0	5	0.812	0.0	-	0.000	0.0
6	0.621	123.7	15	0.023	120.9	-	0.000	0.0	9	0.262	-17.8
7	0.461	126.4	16	0.027	-42.8	-	0.000	0.0	10	0.259	180.0
8	0.000	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.457	63.2	9	0.453	0.0	9	0.454	0.0	-	0.000	0.0
10	0.111	180.0	12	0.055	49.2	-	0.000	0.0	1	1.000	0.0
NF 1	16.085	28.0	1	25.041	27.4	1	23.928	11.1	1	9.068	191.1

MODE= 2F, RPM= 1000, FREQUENCY= 55.30 HZ (BLADE 8), 55.18 HZ (BLADE 5), DAMPING= 0.70 %

RECORD NO. 422 MUX 1 (BLD 8)			RECORD NO. 423 MUX 2 (BLD 8)			RECORD NO. 424 MUX 3 (BLD 8)			RECORD NO. 424 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.067	158.0	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.861	180.0	13	0.299	180.0	-	0.000	0.0	5	3.151	180.0
4	0.801	180.0	14	0.000	0.0	-	0.000	0.0	8	1.056	0.0
5	7.505	0.0	5	7.547	0.0	5	8.280	0.0	-	0.000	0.0
6	5.070	0.0	15	2.144	180.0	-	0.000	0.0	9	0.000	0.0
7	3.973	0.0	16	0.092	16.4	-	0.000	0.0	10	0.000	0.0
8	1.069	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	2.613	180.0	9	2.752	180.0	9	2.983	180.0	-	0.000	0.0
10	0.463	180.0	12	4.937	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	9.566	-122.2	1	4.101	7.0	1	4.951	47.2	1	4.950	227.2

MODE= 3F, RPM= 950, FREQUENCY=114.34 HZ (BLADE 8), 114.77 HZ (BLADE 5), DAMPING= 0.32 %

RECORD NO. 426 MUX 1 (BLD 8)			RECORD NO. 427 MUX 2 (BLD 8)			RECORD NO. 428 MUX 3 (BLD 8)			RECORD NO. 428 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.615	180.0	11	0.831	180.0	-	0.000	0.0	-	0.000	0.0
3	0.208	180.0	13	0.204	1.0	-	0.000	0.0	5	0.524	56.8
4	1.397	0.0	14	1.037	0.0	-	0.000	0.0	8	1.051	0.0
5	0.257	114.3	5	0.143	180.0	5	0.156	56.7	-	0.000	0.0
6	0.250	90.5	15	0.669	-12.[illegible]	-	0.000	0.0	9	0.461	180.0
7	0.259	97.4	16	0.193	180.0	-	0.000	0.0	10	0.242	180.0
8	0.799	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.292	54.4	9	0.320	-168.5	9	0.218	165.4	-	0.000	0.0
10	0.136	-152.1	12	0.314	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	6.118	32.2	1	6.535	124.5	1	7.748	-67.3	1	4.216	-172.2

MODE= 1E, RPM= 950, FREQUENCY= 24.48 HZ (BLADE 8), 24.44 HZ (BLADE 5), DAMPING= 0.89 %

RECORD NO. 429 MUX 1 (BLD 8)			RECORD NO. 430 MUX 2 (BLD 8)			RECORD NO. 431 MUX 3 (BLD 8)			RECORD NO. 431 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.000	0.0	1	0.000	0.0	1	0.000	0.0	-	0.000	0.0
2	0.000	0.0	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.000	0.0	13	0.029	180.0	-	0.000	0.0	5	1.000	0.0
4	0.000	0.0	14	0.000	0.0	-	0.000	0.0	8	0.160	0.0
5	1.000	0.0	5	1.000	0.0	5	1.000	0.0	-	0.000	0.0
6	0.570	0.0	15	0.022	180.0	-	0.000	0.0	9	0.237	0.0
7	0.438	0.0	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
8	0.177	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.241	0.0	9	0.228	0.0	9	0.224	0.0	-	0.000	0.0
10	0.038	180.0	12	0.000	0.0	-	0.000	0.0	1	0.000	0.0
NF 5	97.173	71.4	5	94.510	34.7	5	94.438	-30.7	5	69.978	149.3

MODE= 1T, RPM= 950, FREQUENCY= 53.74 HZ (BLADE 8), 50.11 HZ (BLADE 5), DAMPING=-3.60 %

RECORD NO. 437 MUX 1 (BLD 8)			RECORD NO. 438 MUX 2 (BLD 8)			RECORD NO. 439 MUX 3 (BLD 8)			RECORD NO. 439 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	4.855	110.4	1	0.268	156.9	1	0.335	180.0	-	0.000	0.0
2	0.293	-79.7	11	0.079	-135.7	-	0.000	0.0	-	0.000	0.0
3	4.397	-61.9	13	0.094	-18.2	-	0.000	0.0	5	0.396	18.0
4	4.053	-64.5	14	0.079	-21.0	-	0.000	0.0	8	0.053	18.0
5	48.471	104.6	5	2.494	150.2	5	3.213	180.0	-	0.000	0.0
6	33.089	108.1	15	0.736	-22.8	-	0.000	0.0	9	1.000	0.0
7	26.310	109.9	16	0.027	121.6	-	0.000	0.0	10	0.045	180.0
8	7.607	112.2	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.000	0.0	9	1.000	0.0	9	1.000	0.0	-	0.000	0.0
10	2.974	-81.8	12	1.707	-15.6	-	0.000	0.0	1	0.076	-162.0
NF	1.000	0.0	9	0.005	36.3	9	7.968	-117.1	9	25.223	44.9

TABLE 27 MODAL PARAMETERS FOR CONFIGURATION 5(b) AT 0 RPM

MODE= 1F, RPM= 0, FREQUENCY= 5.19 HZ (BLADE 8), 5.37 HZ (BLADE 5), DAMPING= 0.60 %

RECORD NO. 464 MUX 1 (BLD 8)			RECORD NO. 465 MUX 2 (BLD 8)			RECORD NO. 466 MUX 3 (BLD 8)			RECORD NO. 466 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.718	0.0	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.363	0.0	13	0.000	0.0	-	0.000	0.0	5	0.000	0.0
4	0.135	0.0	14	0.069	37.4	-	0.000	0.0	8	1.063	0.0
5	0.153	180.0	5	0.152	180.0	5	0.165	180.0	-	0.000	0.0
6	0.053	162.4	15	0.042	50.1	-	0.000	0.0	9	0.301	180.0
7	0.000	0.0	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
8	0.870	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.388	0.0	9	0.278	48.2	9	0.380	0.0	-	0.000	0.0
10	0.000	0.0	12	0.221	0.0	-	0.000	0.0	1	1.000	0.0
NF 1	14.161	22.4	1	12.956	-71.0	1	13.195	36.6	1	2.072	-93.6

MODE= 2F, RPM= 0, FREQUENCY= 32.32 HZ (BLADE 8), 32.98 HZ (BLADE 5), DAMPING= 0.57 %

RECORD NO. 467 MUX 1 (BLD 8)			RECORD NO. 468 MUX 2 (BLD 8)			RECORD NO. 469 MUX 3 (BLD 8)			RECORD NO. 469 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.109	0.0	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.886	180.0	13	0.000	0.0	-	0.000	0.0	5	0.208	180.0
4	0.641	180.0	14	0.301	180.0	-	0.000	0.0	8	0.976	0.0
5	0.309	180.0	5	0.259	33.3	5	0.314	25.3	-	0.000	0.0
6	0.063	132.9	15	0.172	180.0	-	0.000	0.0	9	0.324	-54.9
7	0.000	0.0	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
8	0.815	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.291	0.0	9	0.309	0.0	9	0.295	15.3	-	0.000	0.0
10	0.000	0.0	12	0.319	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	12.386	-118.1	1	8.307	9.5	1	7.688	-112.4	1	2.365	-10.2

MODE= 3F, RPM= 0, FREQUENCY= 91.23 HZ (BLADE 8), 90.69 HZ (BLADE 5), DAMPING= 1.21 %

RECORD NO. 470 MUX 1 (BLD 8)			RECORD NO. 471 MUX 2 (BLD 8)			RECORD NO. 472 MUX 3 (BLD 8)			RECORD NO. 472 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.368	114.1	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.116	180.0	13	0.000	0.0	-	0.000	0.0	5	0.190	-141.1
4	1.198	0.0	14	0.491	-67.8	-	0.000	0.0	8	1.059	0.0
5	0.265	-47.7	5	0.316	-94.3	5	0.239	-50.3	-	0.000	0.0
6	0.112	15.3	15	0.466	-135.2	-	0.000	0.0	9	0.229	0.0
7	0.000	0.0	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
8	0.000	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.334	0.0	9	0.349	0.0	9	0.356	-123.5	-	0.000	0.0
10	0.000	0.0	12	0.359	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	3.336	4.0	1	3.540	146.3	1	3.457	125.8	1	4.073	125.8

MODE= 1E, RPM= 0, FREQUENCY= 23.66 HZ (BLADE 8), 23.68 HZ (BLADE 5), DAMPING= 0.67 %

RECORD NO. 473 MUX 1 (BLD 8)			RECORD NO. 474 MUX 2 (BLD 8)			RECORD NO. 475 MUX 3 (BLD 8)			RECORD NO. 475 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.023	0.0	1	0.022	0.0	1	0.023	0.0	-	0.000	0.0
2	0.000	0.0	11	0.077	0.0	-	0.000	0.0	-	0.000	0.0
3	0.000	0.0	13	0.035	180.0	-	0.000	0.0	5	1.000	0.0
4	0.000	0.0	14	0.000	0.0	-	0.000	0.0	8	0.149	0.0
5	1.000	0.0	5	1.000	0.0	5	1.000	0.0	-	0.000	0.0
6	0.662	0.0	15	0.021	180.0	-	0.000	0.0	9	0.107	0.0
7	0.000	0.0	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
8	0.199	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.135	0.0	9	0.136	0.0	9	0.135	0.0	-	0.000	0.0
10	0.078	180.0	12	0.000	0.0	-	0.000	0.0	1	0.000	0.0
NF 5	180.179	118.9	5	182.144	88.3	5	179.738	51.0	5	150.757	231.0

MODE= 1T, RPM= 0, FREQUENCY= 44.19 HZ (BLADE 8), 47.22 HZ (BLADE 5), DAMPING= 0.53 %

RECORD NO. 476 MUX 1 (BLD 8)			RECORD NO. 477 MUX 2 (BLD 8)			RECORD NO. 478 MUX 3 (BLD 8)			RECORD NO. 478 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.000	0.0	1	0.021	0.0	1	0.021	0.0	-	0.000	0.0
2	0.000	0.0	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.038	180.0	13	0.000	0.0	-	0.000	0.0	5	0.000	0.0
4	0.000	0.0	14	0.022	180.0	-	0.000	0.0	8	0.540	-99.0
5	0.201	180.0	5	0.208	180.0	5	0.192	180.0	-	0.000	0.0
6	0.085	180.0	15	0.340	0.0	-	0.000	0.0	9	1.000	0.0
7	0.000	0.0	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
8	0.000	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	1.000	0.0	9	1.000	0.0	9	1.000	0.0	-	0.000	0.0
10	0.000	0.0	12	0.998	0.0	-	0.000	0.0	1	0.000	0.0
NF 9	26.965	170.0	9	27.024	88.2	9	26.946	82.6	9	1.247	161.9

TABLE 28 MODAL PARAMETERS FOR CONFIGURATION 5(b) AT 1000 RPM

MODE= 1F, RPM= 1000, FREQUENCY= 18.73 HZ (BLADE 8), 18.71 HZ (BLADE 5), DAMPING= 0.19 %

RECORD NO. 440 MUX 1 (BLD 8)			RECORD NO. 441 MUX 2 (BLD 8)			RECORD NO. 441 MUX 3 (BLD 8)			RECORD NO. 442 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.003	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.303	0.0	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.057	180.0	13	0.056	180.0	-	0.000	0.0	5	1.138	0.0
4	0.024	180.0	14	0.022	20.9	-	0.000	0.0	8	1.251	0.0
5	1.195	0.0	5	1.210	0.0	5	1.190	0.0	-	0.000	0.0
6	0.737	0.0	15	0.022	180.0	-	0.000	0.0	9	0.486	0.0
7	0.562	0.0	16	0.000	0.0	-	0.000	0.0	10	0.310	180.0
8	1.123	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.702	0.0	9	0.707	0.0	9	0.701	0.0	-	0.000	0.0
10	0.166	180.0	12	0.056	0.0	-	0.000	0.0	1	1.000	0.0
NF 1	34.162	-125.3	1	48.141	83.7	1	41.898	125.5	1	31.794	305.5

MODE= 2F, RPM= 1000, FREQUENCY= 55.50 HZ (BLADE 8), 55.15 HZ (BLADE 5), DAMPING= 0.57 %

RECORD NO. 443 MUX 1 (BLD 8)			RECORD NO. 444 MUX 2 (BLD 8)			RECORD NO. 445 MUX 3 (BLD 8)			RECORD NO. 445 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.040	-22.2	11	0.356	180.0	-	0.000	0.0	-	0.000	0.0
3	0.858	180.0	13	0.212	180.0	-	0.000	0.0	5	2.088	0.0
4	0.794	180.0	14	0.000	0.0	-	0.000	0.0	8	1.020	0.0
5	7.518	-27.2	5	6.193	30.3	5	9.300	180.0	-	0.000	0.0
6	5.239	-26.9	15	1.673	180.0	-	0.000	0.0	9	8.393	0.0
7	4.128	-27.9	16	0.090	13.8	-	0.000	0.0	10	0.000	0.0
8	0.866	-10.1	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	2.630	165.2	9	2.000	180.0	9	0.000	0.0	-	0.000	0.0
10	0.453	152.1	12	3.766	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	3.585	-13.9	1	6.993	-54.9	1	5.975	179.1	1	7.213	359.1

MODE= 3F, RPM= 1000, FREQUENCY=116.65 HZ (BLADE 8), 116.63 HZ (BLADE 5), DAMPING= 0.12 %

RECORD NO. 446 MUX 1 (BLD 8)			RECORD NO. 447 MUX 2 (BLD 8)			RECORD NO. 446 MUX 3 (BLD 8)			RECORD NO. 448 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1			1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2			11	0.809	180.0	-	0.000	0.0	-	0.000	0.0
3			13	0.185	15.1	-	0.000	0.0	5	0.399	-62.2
4			14	0.000	0.0	-	0.000	0.0	8	1.084	0.0
5			5	0.221	-140.2	5	0.104	180.0	-	0.000	0.0
6			15	0.616	0.0	-	0.000	0.0	9	0.433	49.0
7			16	0.156	-166.8	-	0.000	0.0	10	0.316	-149.9
8			-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9			9	0.170	0.0	9	0.191	0.0	-	0.000	0.0
10			12	0.411	180.0	-	0.000	0.0	1	1.000	0.0
NF 1			1	9.861	79.4	1	9.417	-77.3	1	6.834	53.6

MODE= 1E, RPM= 1000, FREQUENCY= 24.83 HZ (BLADE 8), 24.83 HZ (BLADE 5), DAMPING= 0.79 %

RECORD NO. 449 MUX 1 (BLD 8)			RECORD NO. 450 MUX 2 (BLD 8)			RECORD NO. 451 MUX 3 (BLD 8)			RECORD NO. 451 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.000	0.0	1	0.000	0.0	1	0.000	0.0	-	0.000	0.0
2	0.000	0.0	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.000	0.0	13	0.027	180.0	-	0.000	0.0	5	1.000	0.0
4	0.000	0.0	14	0.000	0.0	-	0.000	0.0	8	0.135	0.0
5	1.000	0.0	5	1.000	0.0	5	1.000	0.0	-	0.000	0.0
6	0.564	0.0	15	0.000	0.0	-	0.000	0.0	9	0.248	0.0
7	0.434	0.0	16	0.000	0.0	-	0.000	0.0	10	0.054	180.0
8	0.167	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.240	0.0	9	0.239	0.0	9	0.238	0.0	-	0.000	0.0
10	0.039	180.0	12	0.000	0.0	-	0.000	0.0	1	0.027	-158.9
NF 5	142.404	82.5	5	141.288	73.4	5	132.189	-104.8	5	99.627	75.2

MODE= 1T, RPM= 1000, FREQUENCY= 50.23 HZ (BLADE 8), 50.51 HZ (BLADE 5), DAMPING=-0.74 %

RECORD NO. 456 MUX 1 (BLD 8)			RECORD NO. 457 MUX 2 (BLD 8)			RECORD NO. 459 MUX 3 (BLD 8)			RECORD NO. 459 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.180	158.8	1	0.220	180.0	1	2.599	142.1	-	0.000	0.0
2	0.031	167.3	11	0.126	180.0	-	0.000	0.0	-	0.000	0.0
3	0.146	0.0	13	0.062	-48.3	-	0.000	0.0	5	0.426	133.7
4	0.146	-10.2	14	0.063	111.9	-	0.000	0.0	8	0.140	180.0
5	1.856	151.4	5	2.020	180.0	5	22.079	145.5	-	0.000	0.0
6	1.344	154.9	15	0.732	0.0	-	0.000	0.0	9	1.000	0.0
7	0.000	0.0	16	0.069	180.0	-	0.000	0.0	10	0.000	0.0
8	0.226	119.3	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	1.000	0.0	9	1.000	0.0	9	0.000	0.0	-	0.000	0.0
10	0.144	-38.4	12	1.554	0.0	-	0.000	0.0	1	0.068	180.0
NF 5	5.924	26.8	5	2.753	-141.7		1.000	0.0	5	24.327	46.3

TABLE 29 MODAL PARAMETERS FOR CONFIGURATION 6(a) AT 0 RPM

MODE= 1F, RPM= 0, FREQUENCY= 5.18 HZ (BLADE 8), 5.35 HZ (BLADE 5), DAMPING= 0.53 %

RECORD NO. 479 MUX 1 (BLD 8)			RECORD NO. 480 MUX 2 (BLD 8)			RECORD NO. 481 MUX 3 (BLD 8)			RECORD NO. 481 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.729	0.0	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.370	0.0	13	0.000	0.0	-	0.000	0.0	5	0.000	0.0
4	0.130	0.0	14	0.065	0.0	-	0.000	0.0	8	1.018	0.0
5	0.143	151.2	5	0.145	180.0	5	0.130	180.0	-	0.000	0.0
6	0.042	132.3	15	0.043	72.9	-	0.000	0.0	9	0.168	0.0
7	0.000	0.0	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
8	0.000	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.395	0.0	9	0.404	0.0	9	0.408	0.0	-	0.000	0.0
10	0.000	0.0	12	0.234	0.0	-	0.000	0.0	1	1.000	0.0
NF 1	11.057	-111.2	1	10.228	125.6	1	11.291	-154.9	1	18.170	-317.5

MODE= 2F, RPM= 0, FREQUENCY= 32.05 HZ (BLADE 8), 32.70 HZ (BLADE 5), DAMPING= 0.68 %

RECORD NO. 482 MUX 1 (BLD 8)			RECORD NO. 483 MUX 2 (BLD 8)			RECORD NO. 484 MUX 3 (BLD 8)			RECORD NO. 484 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.113	0.0	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.890	180.0	13	0.000	0.0	-	0.000	0.0	5	0.000	0.0
4	0.651	180.0	14	0.334	180.0	-	0.000	0.0	8	1.027	0.0
5	0.268	-32.7	5	0.270	165.5	5	0.380	14.7	-	0.000	0.0
6	0.049	-36.3	15	0.208	165.9	-	0.000	0.0	9	0.124	0.0
7	0.000	0.0	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
8	0.000	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.294	0.0	9	0.265	0.0	9	0.320	58.1	-	0.000	0.0
10	0.000	0.0	12	0.370	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	5.488	10.5	1	6.889	29.5	1	6.894	153.0	1	13.811	333.0

MODE= 3F, RPM= 0, FREQUENCY= 90.23 HZ (BLADE 8), 90.47 HZ (BLADE 5), DAMPING= 0.34 %

RECORD NO. 491 MUX 1 (BLD 8)			RECORD NO. 492 MUX 2 (BLD 8)			RECORD NO. 493 MUX 3 (BLD 8)			RECORD NO. 493 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.609	180.0	11	0.847	180.0	-	0.000	0.0	-	0.000	0.0
3	0.104	180.0	13	0.168	0.0	-	0.000	0.0	5	0.231	180.0
4	1.276	0.0	14	0.840	0.0	-	0.000	0.0	8	1.078	0.0
5	0.069	180.0	5	0.055	162.5	5	0.067	180.0	-	0.000	0.0
6	0.134	10.5	15	0.369	0.0	-	0.000	0.0	9	0.214	0.0
7	0.092	16.7	16	0.159	180.0	-	0.000	0.0	10	0.263	180.0
8	0.847	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.341	0.0	9	0.335	0.0	9	0.335	0.0	-	0.000	0.0
10	0.131	180.0	12	0.460	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	5.987	-58.9	1	5.871	-91.5	1	5.902	-173.8	1	7.148	-185.6

MODE= 1E, RPM= 0, FREQUENCY= 19.98 HZ (BLADE 8), 20.08 HZ (BLADE 5), DAMPING= 0.69 %

RECORD NO. 488 MUX 1 (BLD 8)			RECORD NO. 489 MUX 2 (BLD 8)			RECORD NO. 490 MUX 3 (BLD 8)			RECORD NO. 490 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.023	0.0	1	0.022	0.0	1	0.023	0.0	-	0.000	0.0
2	0.000	0.0	11	0.073	0.0	-	0.000	0.0	-	0.000	0.0
3	0.000	0.0	13	0.036	180.0	-	0.000	0.0	5	1.000	0.0
4	0.000	0.0	14	0.000	0.0	-	0.000	0.0	8	0.156	0.0
5	1.000	0.0	5	1.000	0.0	5	1.000	0.0	-	0.000	0.0
6	0.657	0.0	15	0.033	180.0	-	0.000	0.0	9	0.047	0.0
7	0.500	0.0	16	0.000	0.0	-	0.000	0.0	10	0.075	180.0
8	0.189	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.076	0.0	9	0.078	0.0	9	0.078	0.0	-	0.000	0.0
10	0.081	180.0	12	0.024	180.0	-	0.000	0.0	1	0.000	0.0
NF 5	59.104	-89.1	5	60.193	-63.9	5	59.324	112.7	5	47.907	292.7

MODE= 1T, RPM= 0, FREQUENCY= 37.75 HZ (BLADE 8), 37.80 HZ (BLADE 5), DAMPING= 0.40 %

RECORD NO. 494 MUX 1 (BLD 8)			RECORD NO. 495 MUX 2 (BLD 8)			RECORD NO. 496 MUX 3 (BLD 8)			RECORD NO. 496 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.291	-14.1	1	0.279	0.0	1	0.305	-17.5	-	0.000	0.0
2	0.000	0.0	11	0.061	0.0	-	0.000	0.0	-	0.000	0.0
3	0.462	162.9	13	0.307	0.0	-	0.000	0.0	5	1.000	0.0
4	0.279	164.8	14	0.175	164.1	-	0.000	0.0	8	0.170	0.0
5	1.000	0.0	5	1.000	0.0	5	1.000	0.0	-	0.000	0.0
6	1.148	-10.1	15	1.999	-12.0	-	0.000	0.0	9	0.936	180.0
7	1.349	-12.0	16	0.177	0.0	-	0.000	0.0	10	0.052	180.0
8	1.822	-17.3	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	7.252	-19.0	9	7.289	-10.7	9	7.526	0.0	-	0.000	0.0
10	0.031	-100.1	12	6.444	-11.0	-	0.000	0.0	1	0.094	0.0
NF 5	2.107	-99.6	5	1.957	-54.7	5	1.979	-51.6	5	1.854	128.4

TABLE 30 MODAL PARAMETERS FOR CONFIGURATION 6(a) AT 410/710 RPM

MODE= 1F, RPM= 410, FREQUENCY= 9.38 HZ (BLADE 8), 9.53 HZ (BLADE 5), DAMPING= 0.42 %

RECORD NO. 524 MUX 1 (BLD 8)			RECORD NO. 525 MUX 2 (BLD 8)			RECORD NO. 525 MUX 3 (BLD 8)			RECORD NO. 526 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.000	0.0	11	0.261	0.0	-	0.000	0.0	-	0.000	0.0
3	0.000	0.0	13	0.035	180.0	-	0.000	0.0	5	0.193	180.0
4	0.187	35.3	14	0.062	180.0	-	0.000	0.0	8	1.007	0.0
5	0.293	-163.3	5	0.183	180.0	5	0.122	-149.7	-	0.000	0.0
6	0.137	180.0	15	0.040	180.0	-	0.000	0.0	9	0.176	0.0
7	0.000	0.0	16	0.021	-161.1	-	0.000	0.0	10	0.219	180.0
8	0.813	-145.6	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.765	180.0	9	0.405	0.0	9	0.401	0.0	-	0.000	0.0
10	0.395	-45.3	12	0.138	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	5.714	-27.7	1	9.289	-126.4	1	17.670	127.9	1	21.441	307.9

MODE= 1E, RPM= 410, FREQUENCY= 21.33 HZ (BLADE 8), 21.33 HZ (BLADE 5), DAMPING= 0.47 %

RECORD NO. 521 MUX 1 (BLD 8)			RECORD NO. 522 MUX 2 (BLD 8)			RECORD NO. 523 MUX 3 (BLD 8)			RECORD NO. 523 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.000	0.0	1	0.000	0.0	1	0.000	0.0	-	0.000	0.0
2	0.000	0.0	11	0.072	0.0	-	0.000	0.0	-	0.000	0.0
3	0.000	0.0	13	0.029	165.9	-	0.000	0.0	5	1.000	0.0
4	0.000	0.0	14	0.000	0.0	-	0.000	0.0	8	0.152	0.0
5	1.000	0.0	5	1.000	0.0	5	1.000	0.0	-	0.000	0.0
6	0.633	0.0	15	0.022	169.5	-	0.000	0.0	9	0.267	0.0
7	0.485	0.0	16	0.000	0.0	-	0.000	0.0	10	0.673	180.0
8	0.202	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.277	0.0	9	0.276	0.0	9	0.277	0.0	-	0.000	0.0
10	0.053	180.0	12	0.026	0.0	-	0.000	0.0	1	0.000	0.0
NF 5	57.274	-3.6	5	60.262	-132.3	5	130.387	36.3	5	98.017	216.3

MODE= 1F, RPM= 710, FREQUENCY= 14.26 HZ (BLADE 8), 14.22 HZ (BLADE 5), DAMPING=-0.15 %

RECORD NO. 515 MUX 1 (BLD 8)			RECORD NO. 516 MUX 2 (BLD 8)			RECORD NO. 517 MUX 3 (BLD 8)			RECORD NO. 517 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.438	80.8	11	0.174	0.0	-	0.000	0.0	-	0.000	0.0
3	0.116	0.0	13	0.028	99.4	-	0.000	0.0	5	0.154	-99.8
4	0.057	101.2	14	0.115	0.0	-	0.000	0.0	8	1.030	0.0
5	0.184	128.0	5	1.028	108.4	5	0.109	180.0	-	0.000	0.0
6	0.094	100.3	15	0.084	-165.2	-	0.000	0.0	9	0.220	0.0
7	0.055	136.1	16	0.037	154.2	-	0.000	0.0	10	0.230	67.2
8	0.873	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.411	0.0	9	1.423	110.2	9	0.413	0.0	-	0.000	0.0
10	0.076	180.0	12	0.084	-94.6	-	0.000	0.0	1	1.000	0.0
NF 1	22.996	-144.0	1	1.713	-46.8	1	21.956	-136.1	1	11.350	-25.3

MODE= 2F, RPM= 710, FREQUENCY= 45.32 HZ (BLADE 8), 45.43 HZ (BLADE 5), DAMPING= 0.52 %

RECORD NO. 518 MUX 1 (BLD 8)			RECORD NO. 519 MUX 2 (BLD 8)			RECORD NO. 520 MUX 3 (BLD 8)			RECORD NO. 520 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.042	80.5	11	0.570	180.0	-	0.000	0.0	-	0.000	0.0
3	0.854	180.0	13	0.127	0.0	-	0.000	0.0	5	0.290	180.0
4	0.712	180.0	14	0.379	180.0	-	0.000	0.0	8	1.042	11.0
5	0.353	-61.9	5	0.452	180.0	5	0.357	180.0	-	0.000	0.0
6	0.146	26.7	15	0.095	180.0	-	0.000	0.0	9	0.478	11.0
7	0.178	89.7	16	0.098	45.1	-	0.000	0.0	10	0.256	180.0
8	0.892	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.712	0.0	9	0.669	0.0	9	0.696	0.0	-	0.000	0.0
10	0.396	180.0	12	0.106	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	17.656	-2.4	1	19.480	56.0	1	12.455	112.7	1	22.175	101.7

MODE= 1E, RPM= 710, FREQUENCY= 21.79 HZ (BLADE 8), 21.75 HZ (BLADE 5), DAMPING= 0.72 %

RECORD NO. 512 MUX 1 (BLD 8)			RECORD NO. 513 MUX 2 (BLD 8)			RECORD NO. 514 MUX 3 (BLD 8)			RECORD NO. 514 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.000	0.0	1	0.021	153.8	1	0.021	0.0	-	0.000	0.0
2	0.000	0.0	11	0.072	0.0	-	0.000	0.0	-	0.000	0.0
3	0.000	0.0	13	0.029	160.0	-	0.000	0.0	5	1.000	0.0
4	0.000	0.0	14	0.000	0.0	-	0.000	0.0	8	0.156	0.0
5	1.000	0.0	5	1.000	0.0	5	1.000	0.0	-	0.000	0.0
6	0.598	0.0	15	0.000	0.0	-	0.000	0.0	9	0.266	0.0
7	0.456	0.0	16	0.000	0.0	-	0.000	0.0	10	0.065	180.0
8	0.189	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.263	0.0	9	0.263	0.0	9	0.259	0.0	-	0.000	0.0
10	0.045	180.0	12	0.000	0.0	-	0.000	0.0	1	0.000	0.0
NF 5	114.444	-14.1	5	113.466	-20.8	5	100.018	156.4	5	75.343	336.4

TABLE 31 MODAL PARAMETERS FOR CONFIGURATION 6(a) AT 1012 RPM

MODE= 1F, RPM= 1012, FREQUENCY= 19.50 HZ (BLADE 8), 19.61 HZ (BLADE 5), DAMPING= 0.11 %

RECORD NO. 500 MUX 1 (BLD 8)			RECORD NO. 501 MUX 2 (BLD 8)			RECORD NO. 502 MUX 3 (BLD 8)			RECORD NO. 502 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.302	0.0	11	0.117	0.0	-	0.000	0.0	-	0.000	0.0
3	0.062	0.0	13	0.023	180.0	-	0.000	0.0	5	0.351	-53.7
4	0.026	-78.3	14	0.000	0.0	-	0.000	0.0	8	1.074	0.0
5	0.345	-62.8	5	0.337	-67.8	5	0.351	-69.3	-	0.000	0.0
6	0.154	-92.2	15	0.000	0.0	-	0.000	0.0	9	0.272	0.0
7	0.139	-50.8	16	0.000	0.0	-	0.000	0.0	10	0.252	180.0
8	0.913	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.474	0.0	9	0.466	0.0	9	0.468	0.0	-	0.000	0.0
10	0.118	180.0	12	0.052	0.0	-	0.000	0.0	1	1.000	0.0
NF 1	30.089	-84.1	1	33.104	13.1	1	30.904	62.0	1	17.551	132.0

MODE= 2F, RPM= 1012, FREQUENCY= 55.58 HZ (BLADE 8), 55.61 HZ (BLADE 5), DAMPING=-0.44 %

RECORD NO. 503 MUX 1 (BLD 8)			RECORD NO. 504 MUX 2 (BLD 8)			RECORD NO. 505 MUX 3 (BLD 8)			RECORD NO. 505 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.000	0.0	11	0.545	180.0	-	0.000	0.0	-	0.000	0.0
3	0.827	180.0	13	0.118	0.0	-	0.000	0.0	5	0.184	180.0
4	0.773	180.0	14	0.535	180.0	-	0.000	0.0	8	1.059	0.0
5	0.289	-40.8	5	0.290	0.0	5	0.306	-35.0	-	0.000	0.0
6	0.000	0.0	15	0.110	180.0	-	0.000	0.0	9	0.346	0.0
7	0.109	148.9	16	0.090	0.0	-	0.000	0.0	10	0.252	180.0
8	0.865	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.552	0.0	9	0.562	0.0	9	0.557	0.0	-	0.000	0.0
10	0.105	180.0	12	0.028	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	13.254	-144.3	1	12.013	-141.1	1	14.595	96.8	1	18.528	96.8

MODE= 3F, RPM= 1012, FREQUENCY=116.85 HZ (BLADE 8), 116.63 HZ (BLADE 5), DAMPING= 0.57 %

RECORD NO. 506 MUX 1 (BLD 8)			RECORD NO. 507 MUX 2 (BLD 8)			RECORD NO. 508 MUX 3 (BLD 8)			RECORD NO. 508 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.000	0.0	11	1.035	162.4	-	0.000	0.0	-	0.000	0.0
3	0.000	0.0	13	0.294	40.9	-	0.000	0.0	5	0.251	180.0
4	1.546	0.0	14	1.076	180.0	-	0.000	0.0	8	1.062	0.0
5	0.765	180.0	5	0.809	180.0	5	0.559	180.0	-	0.000	0.0
6	1.645	-101.8	15	0.582	180.0	-	0.000	0.0	9	0.221	53.7
7	0.000	0.0	16	0.279	49.1	-	0.000	0.0	10	0.242	180.0
8	0.871	-11.4	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.489	-109.6	9	0.472	180.0	9	0.225	-79.2	-	0.000	0.0
10	0.138	180.0	12	0.668	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	10.131	-95.6	1	9.906	-176.4	1	11.682	-67.3	1	19.008	-80.4

MODE= 1E, RPM= 1012, FREQUENCY= 22.25 HZ (BLADE 8), 22.39 HZ (BLADE 5), DAMPING= 0.78 %

RECORD NO. 509 MUX 1 (BLD 8)			RECORD NO. 510 MUX 2 (BLD 8)			RECORD NO. 511 MUX 3 (BLD 8)			RECORD NO. 511 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.035	-89.3	1	0.022	-118.4	1	0.027	-28.5	-	0.000	0.0
2	0.000	0.0	11	0.044	-54.0	-	0.000	0.0	-	0.000	0.0
3	0.000	0.0	13	0.029	180.0	-	0.000	0.0	5	1.000	0.0
4	0.000	0.0	14	0.000	0.0	-	0.000	0.0	8	0.169	0.0
5	1.000	0.0	5	1.000	0.0	5	1.000	0.0	-	0.000	0.0
6	0.549	0.0	15	0.000	0.0	-	0.000	0.0	9	0.216	0.0
7	0.407	0.0	16	0.000	0.0	-	0.000	0.0	10	0.039	180.0
8	0.156	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.199	0.0	9	0.201	0.0	9	0.201	0.0	-	0.000	0.0
10	0.036	180.0	12	0.000	0.0	-	0.000	0.0	1	0.048	0.0
NF 5	76.275	-131.4	5	78.482	12.0	5	66.318	123.5	5	50.758	303.5

MODE= 1T, RPM= 1012, FREQUENCY= 40.63 HZ (BLADE 8), 40.67 HZ (BLADE 5), DAMPING= 2.00 %

RECORD NO. 497 MUX 1 (BLD 8)			RECORD NO. 498 MUX 2 (BLD 8)			RECORD NO. 499 MUX 3 (BLD 8)			RECORD NO. 499 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.041	82.5	1	0.036	0.0	1	0.085	180.0	-	0.000	0.0
2	0.026	180.0	11	0.266	0.0	-	0.000	0.0	-	0.000	0.0
3	0.059	113.2	13	0.110	-28.4	-	0.000	0.0	5	2.200	-67.2
4	0.031	121.5	14	0.643	-137.2	-	0.000	0.0	8	0.544	180.0
5	3.151	180.0	5	3.347	-11.5	5	3.131	0.0	-	0.000	0.0
6	2.001	180.0	15	0.179	180.0	-	0.000	0.0	9	1.000	0.0
7	1.650	180.0	16	0.034	-17.9	-	0.000	0.0	10	0.145	115.1
8	0.606	180.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	1.000	0.0	9	1.000	0.0	9	1.000	0.0	-	0.000	0.0
10	0.105	180.0	12	0.470	77.1	-	0.000	0.0	1	0.000	0.0
NF 9	6.297	178.9	9	7.831	87.3	9	4.026	-107.0	9	3.230	-118.7

TABLE 32 MODAL PARAMETERS FOR CONFIGURATION 6(b) AT 0 RPM

DATA NOT AVAILABLE

MODE= 2F, RPM= 0, FREQUENCY= 32.82 HZ (BLADE 8), 32.68 HZ (BLADE 5), DAMPING= 0.60 %

RECORD NO. 530 MUX 1 (BLD 8)			RECORD NO. 531 MUX 2 (BLD 8)			RECORD NO. 532 MUX 3 (BLD 8)			RECORD NO. 532 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.124	0.0	11	0.632	180.0	-	0.000	0.0	-	0.000	0.0
3	0.873	180.0	13	0.121	0.0	-	0.000	0.0	5	0.257	180.0
4	0.639	180.0	14	0.315	180.0	-	0.000	0.0	8	1.071	0.0
5	0.770	180.0	5	0.784	180.0	5	0.766	180.0	-	0.000	0.0
6	0.374	180.0	15	0.137	180.0	-	0.000	0.0	9	0.121	0.0
7	0.000	0.0	16	0.054	0.0	-	0.000	0.0	10	0.236	180.0
8	0.762	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.321	0.0	9	0.340	-108.1	9	0.228	-52.3	-	0.000	0.0
10	0.071	74.0	12	0.172	128.1	-	0.000	0.0	1	1.000	0.0
NF 1	6.974	28.1	1	6.297	-78.2	1	7.070	-77.2	1	41.228	-77.2

MODE= 3F, RPM= 0, FREQUENCY= 90.32 HZ (BLADE 8), 90.45 HZ (BLADE 5), DAMPING= 0.44 %

RECORD NO. 533 MUX 1 (BLD 8)			RECORD NO. 534 MUX 2 (BLD 8)			RECORD NO. 535 MUX 3 (BLD 8)			RECORD NO. 535 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.000	0.0	11	0.838	180.0	-	0.000	0.0	-	0.000	0.0
3	0.000	0.0	13	0.167	0.0	-	0.000	0.0	5	0.208	180.0
4	10.323	-37.7	14	0.840	0.0	-	0.000	0.0	8	1.076	0.0
5	0.391	95.6	5	0.046	180.0	5	0.051	180.0	-	0.000	0.0
6	1.598	-19.6	15	0.375	0.0	-	0.000	0.0	9	0.236	0.0
7	0.000	0.0	16	0.159	180.0	-	0.000	0.0	10	0.256	180.0
8	7.040	-38.8	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	2.918	-37.6	9	0.354	0.0	9	0.355	0.0	-	0.000	0.0
10	1.038	142.6	12	0.445	180.0	-	0.000	0.0	1	1.000	0.0
NF	1.000	0.0	1	7.124	-173.4	1	7.158	106.9	1	8.179	106.9

MODE= 1E, RPM= 0, FREQUENCY= 19.98 HZ (BLADE 8), 20.02 HZ (BLADE 5), DAMPING= 0.65 %

RECORD NO. 536 MUX 1 (BLD 8)			RECORD NO. 537 MUX 2 (BLD 8)			RECORD NO. 538 MUX 3 (BLD 8)			RECORD NO. 538 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.000	0.0	1	0.030	-30.2	1	0.000	0.0	-	0.000	0.0
2	0.000	0.0	11	0.067	-110.1	-	0.000	0.0	-	0.000	0.0
3	0.000	0.0	13	0.050	180.0	-	0.000	0.0	5	1.000	0.0
4	0.000	0.0	14	0.000	0.0	-	0.000	0.0	8	0.148	0.0
5	1.000	0.0	5	1.000	0.0	5	1.000	0.0	-	0.000	0.0
6	0.656	0.0	15	0.044	180.0	-	0.000	0.0	9	0.041	113.7
7	0.000	0.0	16	0.000	0.0	-	0.000	0.0	10	0.089	-83.0
8	0.197	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.086	0.0	9	0.075	-114.2	9	0.091	-13.2	-	0.000	0.0
10	0.078	75.6	12	0.035	180.0	-	0.000	0.0	1	0.000	0.0
NF 5	64.078	-31.8	5	82.429	84.1	5	83.786	-85.0	5	65.430	-18.7

MODE= 1T, RPM= 0, FREQUENCY= 37.81 HZ (BLADE 8), 38.51 HZ (BLADE 5), DAMPING= 0.64 %

RECORD NO. 539 MUX 1 (BLD 8)			RECORD NO. 540 MUX 2 (BLD 8)			RECORD NO. 541 MUX 3 (BLD 8)			RECORD NO. 541 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.022	24.1	1	0.022	-120.3	1	0.021	0.0	-	0.000	0.0
2	0.000	0.0	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.051	180.0	13	0.040	0.0	-	0.000	0.0	5	0.511	180.0
4	0.028	-165.7	14	0.000	0.0	-	0.000	0.0	8	0.000	0.0
5	0.125	18.6	5	0.125	21.7	5	0.103	180.0	-	0.000	0.0
6	0.141	12.7	15	0.274	0.0	-	0.000	0.0	9	1.000	0.0
7	0.000	0.0	16	0.000	0.0	-	0.000	0.0	10	0.000	0.0
8	0.235	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	1.000	0.0	9	1.000	0.0	9	1.000	0.0	-	0.000	0.0
10	0.000	0.0	12	0.895	0.0	-	0.000	0.0	1	0.000	0.0
NF 9	15.898	66.3	9	15.016	-23.1	9	15.651	114.4	9	3.928	-42.1

TABLE 33 MODAL PARAMETERS FOR CONFIGURATION 6(b) AT 1000 RPM

MODE= 1F, RPM= 1000, FREQUENCY= 18.50 HZ (BLADE 8), 18.49 HZ (BLADE 5), DAMPING= 0.27 %

RECORD NO. 549 MUX 1 (BLD 8)			RECORD NO. 550 MUX 2 (BLD 8)			RECORD NO. 551 MUX 3 (BLD 8)			RECORD NO. 551 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.299	0.0	11	0.214	0.0	-	0.000	0.0	-	0.000	0.0
3	0.055	0.0	13	0.064	180.0	-	0.000	0.0	5	1.607	0.0
4	0.023	-15.3	14	0.026	0.0	-	0.000	0.0	8	1.323	0.0
5	1.648	0.0	5	1.629	0.0	5	1.727	0.0	-	0.000	0.0
6	0.985	0.0	15	0.028	117.5	-	0.000	0.0	9	0.588	0.0
7	0.685	0.0	16	0.030	132.6	-	0.000	0.0	10	0.340	-168.1
8	1.183	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.778	0.0	9	0.777	0.0	9	0.794	0.0	-	0.000	0.0
10	0.194	180.0	12	0.051	0.0	-	0.000	0.0	1	1.000	0.0
NF 1	25.443	17.5	1	24.237	-146.9	1	25.291	-57.4	1	19.918	122.6

MODE= 2F, RPM= 1000, FREQUENCY= 55.24 HZ (BLADE 8), 55.28 HZ (BLADE 5), DAMPING= 0.11 %

RECORD NO. 552 MUX 1 (BLD 8)			RECORD NO. 553 MUX 2 (BLD 8)			RECORD NO. 554 MUX 3 (BLD 8)			RECORD NO. 554 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.045	67.1	11	0.548	180.0	-	0.000	0.0	-	0.000	0.0
3	0.825	180.0	13	0.123	0.0	-	0.000	0.0	5	1.313	-25.4
4	0.770	180.0	14	0.435	180.0	-	0.000	0.0	8	1.042	0.0
5	1.878	91.3	5	1.626	180.0	5	2.212	-30.2	-	0.000	0.0
6	1.297	92.4	15	0.180	-63.2	-	0.000	0.0	9	0.305	-10.8
7	1.026	94.7	16	0.088	0.0	-	0.000	0.0	10	0.251	180.0
8	0.865	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.535	0.0	9	0.530	0.0	9	0.525	0.0	-	0.000	0.0
10	0.112	180.0	12	0.196	-63.3	-	0.000	0.0	1	1.000	0.0
NF 1	14.962	6.6	1	17.248	72.6	1	11.573	72.9	1	14.517	72.9

MODE= 3F, RPM= 1000, FREQUENCY=116.39 HZ (BLADE 8), 116.16 HZ (BLADE 5), DAMPING= 0.41 %

RECORD NO. 555 MUX 1 (BLD 8)			RECORD NO. 556 MUX 2 (BLD 8)			RECORD NO. 557 MUX 3 (BLD 8)			RECORD NO. 557 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.661	180.0	11	0.788	180.0	-	0.000	0.0	-	0.000	0.0
3	0.214	180.0	13	0.119	67.0	-	0.000	0.0	5	0.220	167.6
4	1.495	0.0	14	1.103	0.0	-	0.000	0.0	8	1.103	0.0
5	0.202	13.8	5	0.140	160.1	5	0.195	169.3	-	0.000	0.0
6	0.168	122.7	15	0.520	0.0	-	0.000	0.0	9	0.285	0.0
7	0.206	33.5	16	0.215	180.0	-	0.000	0.0	10	0.290	167.6
8	0.870	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.286	13.4	9	0.340	102.9	9	0.345	101.4	-	0.000	0.0
10	0.119	180.0	12	0.499	165.3	-	0.000	0.0	1	1.000	0.0
NF 1	9.480	-105.0	1	9.809	-82.1	1	8.799	-145.1	1	16.269	-132.7

MODE= 1E, RPM= 1000, FREQUENCY= 22.74 HZ (BLADE 8), 22.82 HZ (BLADE 5), DAMPING= 0.52 %

RECORD NO. 545 MUX 1 (BLD 8)			RECORD NO. 547 MUX 2 (BLD 8)			RECORD NO. 548 MUX 3 (BLD 8)			RECORD NO. 548 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.055	-165.6	1	0.055	180.0	1	0.052	180.0	-	0.000	0.0
2	0.029	-166.2	11	0.057	0.0	-	0.000	0.0	-	0.000	0.0
3	0.000	0.0	13	0.027	180.0	-	0.000	0.0	5	1.000	0.0
4	0.000	0.0	14	0.000	0.0	-	0.000	0.0	8	0.095	0.0
5	1.000	0.0	5	1.000	0.0	5	1.000	0.0	-	0.000	0.0
6	0.430	0.0	15	0.003	0.0	-	0.000	0.0	9	0.220	0.0
7	0.412	0.0	16	0.000	0.0	-	0.000	0.0	10	0.045	180.0
8	0.141	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.237	10.6	9	0.203	0.0	9	0.206	0.0	-	0.000	0.0
10	0.062	-169.1	12	0.003	0.0	-	0.000	0.0	1	0.065	-165.9
NF 5	117.531	56.6	5	80.648	-100.2	5	83.880	134.8	5	62.614	314.8

MODE= 1T, RPM= 1000, FREQUENCY= 40.17 HZ (BLADE 8), 40.46 HZ (BLADE 5), DAMPING= 1.40 %

RECORD NO. 542 MUX 1 (BLD 8)			RECORD NO. 543 MUX 2 (BLD 8)			RECORD NO. 544 MUX 3 (BLD 8)			RECORD NO. 544 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.090	0.0	1	0.091	-18.0	1	0.089	0.0	-	0.000	0.0
2	0.039	180.0	11	0.215	0.0	-	0.000	0.0	-	0.000	0.0
3	0.000	0.0	13	0.067	180.0	-	0.000	0.0	5	2.763	-13.5
4	0.000	0.0	14	0.034	[illegible]	-	0.000	0.0	8	0.486	-10.9
5	2.427	0.0	5	2.440	0.0	5	2.237	0.0	-	0.000	0.0
6	1.543	0.0	15	0.097	0.0	-	0.000	0.0	9	1.000	0.0
7	1.214	0.0	16	0.000	0.0	-	0.000	0.0	10	0.201	180.0
8	0.595	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	1.000	0.0	9	1.000	0.0	9	1.000	0.0	-	0.000	0.0
10	0.107	180.0	12	0.393	154.5	-	0.000	0.0	1	0.058	72.6
NF 9	12.579	161.2	9	13.102	87.7	9	11.061	173.9	9	7.853	173.9

TABLE 34 MODAL PARAMETERS FOR CONFIGURATION 6(c) AT 0 RPM

MODE= 1F, RPM= 0, FREQUENCY= 5.18 HZ (BLADE 8), 5.34 HZ (BLADE 5), DAMPING= 0.59 %

RECORD NO. 558 MUX 1 (BLD 8)			RECORD NO. 559 MUX 2 (BLD 8)			RECORD NO. 560 MUX 3 (BLD 8)			RECORD NO. 560 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.725	0.0	11	0.465	0.0	-	0.000	0.0	-	0.000	0.0
3	0.367	0.0	13	0.074	180.0	-	0.000	0.0	5	0.200	180.0
4	0.132	0.0	14	0.059	0.0	-	0.000	0.0	8	1.013	0.0
5	0.154	180.0	5	0.146	180.0	5	0.151	180.0	-	0.000	0.0
6	0.048	180.0	15	0.027	11.0	-	0.000	0.0	9	0.167	0.0
7	0.000	0.0	16	0.000	0.0	-	0.000	0.0	10	0.221	180.0
8	0.880	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.402	0.0	9	0.408	0.0	9	0.409	0.0	-	0.000	0.0
10	0.100	180.0	12	0.224	0.0	-	0.000	0.0	1	1.000	0.0
NF 1	17.505	117.2	1	15.984	142.2	1	16.707	-44.6	1	15.409	121.6

MODE= 2F, RPM= 0, FREQUENCY= 32.19 HZ (BLADE 8), 32.77 HZ (BLADE 5), DAMPING= 0.66 %

RECORD NO. 561 MUX 1 (BLD 8)			RECORD NO. 562 MUX 2 (BLD 8)			RECORD NO. 563 MUX 3 (BLD 8)			RECORD NO. 563 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.102	0.0	11	0.590	180.0	-	0.000	0.0	-	0.000	0.0
3	0.900	180.0	13	0.093	101.7	-	0.000	0.0	5	0.167	-168.3
4	0.653	180.0	14	0.309	180.0	-	0.000	0.0	8	1.049	0.0
5	0.223	180.0	5	0.204	-112.5	5	0.213	-109.0	-	0.000	0.0
6	0.071	180.0	15	0.204	180.0	-	0.000	0.0	9	0.096	0.0
7	0.000	0.0	16	0.050	114.8	-	0.000	0.0	10	0.236	180.0
8	0.833	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.245	180.0	9	0.304	79.1	9	0.289	42.5	-	0.000	0.0
10	0.116	180.0	12	0.398	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	6.215	171.5	1	5.831	5.9	1	6.363	-11.2	1	10.514	89.5

MODE= 3F, RPM= 0, FREQUENCY= 90.31 HZ (BLADE 8), 90.40 HZ (BLADE 5), DAMPING= 0.44 %

RECORD NO. 564 MUX 1 (BLD 8)			RECORD NO. 565 MUX 2 (BLD 8)			RECORD NO. 566 MUX 3 (BLD 8)			RECORD NO. 566 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.605	180.0	11	0.859	180.0	-	0.000	0.0	-	0.000	0.0
3	0.105	180.0	13	0.179	0.0	-	0.000	0.0	5	0.247	180.0
4	1.273	0.0	14	0.838	0.0	-	0.000	0.0	8	1.077	0.0
5	0.084	180.0	5	0.088	180.0	5	0.093	180.0	-	0.000	0.0
6	0.064	-13.0	15	0.394	0.0	-	0.000	0.0	9	0.192	0.0
7	0.003	0.0	16	0.156	180.0	-	0.000	0.0	10	0.256	180.0
8	0.844	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.309	0.0	9	0.311	0.0	9	0.312	0.0	-	0.000	0.0
10	0.129	180.0	12	0.465	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	10.588	-80.3	1	10.510	-41.0	1	10.527	53.9	1	12.307	53.9

MODE= 1E, RPM= 0, FREQUENCY= 20.04 HZ (BLADE 8), 20.03 HZ (BLADE 5), DAMPING= 0.67 %

RECORD NO. 567 MUX 1 (BLD 8)			RECORD NO. 568 MUX 2 (BLD 8)			RECORD NO. 569 MUX 3 (BLD 8)			RECORD NO. 569 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.029	0.0	1	0.000	0.0	1	0.000	0.0	-	0.000	0.0
2	0.000	0.0	11	0.095	-25.9	-	0.000	0.0	-	0.000	0.0
3	0.027	180.0	13	0.032	180.0	-	0.000	0.0	5	1.000	0.0
4	0.021	180.0	14	0.032	180.0	-	0.000	0.0	8	0.141	0.0
5	1.000	0.0	5	1.000	0.0	5	1.000	0.0	-	0.000	0.0
6	0.656	0.0	15	0.027	75.5	-	0.000	0.0	9	0.043	0.0
7	0.523	0.0	16	0.028	180.0	-	0.000	0.0	10	0.101	0.0
8	0.194	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.089	-23.8	9	0.102	-24.2	9	0.100	180.0	-	0.000	0.0
10	0.085	-169.6	12	0.026	180.0	-	0.000	0.0	1	0.035	0.0
NF 5	35.132	86.8	5	35.968	155.2	5	36.147	142.0	5	28.136	322.0

MODE= 1T, RPM= 0, FREQUENCY= 37.94 HZ (BLADE 8), 38.47 HZ (BLADE 5), DAMPING= 0.58 %

RECORD NO. 570 MUX 1 (BLD 8)			RECORD NO. 571 MUX 2 (BLD 8)			RECORD NO. 572 MUX 3 (BLD 8)			RECORD NO. 572 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.058	0.0	1	0.059	0.0	1	0.059	0.0	-	0.000	0.0
2	0.003	0.0	11	0.000	0.0	-	0.000	0.0	-	0.000	0.0
3	0.075	180.0	13	0.042	0.0	-	0.000	0.0	5	0.452	-39.8
4	0.049	180.0	14	0.031	88.3	-	0.000	0.0	8	0.183	0.0
5	0.135	0.0	5	0.136	0.0	5	0.132	0.0	-	0.000	0.0
6	0.156	0.0	15	0.270	0.0	-	0.000	0.0	9	1.000	0.0
7	0.003	0.0	16	0.023	0.0	-	0.000	0.0	10	0.000	0.0
8	0.267	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	1.000	0.0	9	1.000	0.0	9	1.000	0.0	-	0.000	0.0
10	0.000	0.0	12	0.878	0.0	-	0.000	0.0	1	0.235	22.1
NF 9	25.053	130.8	9	24.338	-107.7	9	24.507	19.6	9	4.532	-108.9

TABLE 35 MODAL PARAMETERS FOR CONFIGURATION 6(c) AT 1000 RPM

MODE= 1F, RPM= 1000, FREQUENCY= 18.70 HZ (BLADE 8), 18.78 HZ (BLADE 5), DAMPING= 0.26 %

RECORD NO. 573 MUX 1 (BLD 8)			RECORD NO. 574 MUX 2 (BLD 8)			RECORD NO. 575 MUX 3 (BLD 8)			RECORD NO. 575 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.304	0.0	11	0.058	180.0	-	0.000	0.0	-	0.000	0.0
3	0.063	0.0	13	0.056	180.0	-	0.000	0.0	5	1.530	180.0
4	0.023	11.1	14	0.043	-64.9	-	0.000	0.0	8	0.821	0.0
5	2.163	180.0	5	2.208	180.0	5	2.188	180.0	-	0.000	0.0
6	1.136	180.0	15	0.050	180.0	-	0.000	0.0	9	0.060	0.0
7	0.811	180.0	16	0.045	180.0	-	0.000	0.0	10	0.162	-115.4
8	0.545	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.093	-89.4	9	0.094	-26.2	9	0.103	27.6	-	0.000	0.0
10	0.042	-21.3	12	0.082	0.0	-	0.000	0.0	1	1.000	0.0
NF 1	16.076	108.3	1	11.766	-91.8	1	9.607	-88.2	1	10.727	91.8

MODE= 2F, RPM= 1000, FREQUENCY= 55.17 HZ (BLADE 8), 55.32 HZ (BLADE 5), DAMPING=-0.17 %

RECORD NO. 576 MUX 1 (BLD 8)			RECORD NO. 577 MUX 2 (BLD 8)			RECORD NO. 578 MUX 3 (BLD 8)			RECORD NO. 578 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.000	0.0	11	0.541	180.0	-	0.000	0.0	-	0.000	0.0
3	0.826	180.0	13	0.116	0.0	-	0.000	0.0	5	0.852	180.0
4	0.769	180.0	14	0.434	180.0	-	0.000	0.0	8	1.052	0.0
5	1.334	-60.8	5	1.576	-53.7	5	1.367	180.0	-	0.000	0.0
6	0.901	-56.6	15	0.134	180.0	-	0.000	0.0	9	0.378	0.0
7	0.758	-54.8	16	0.084	0.0	-	0.000	0.0	10	0.247	180.0
8	0.863	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.581	0.0	9	0.572	0.0	9	0.589	0.0	-	0.000	0.0
10	0.099	180.0	12	0.133	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	17.112	147.1	1	14.952	124.9	1	16.420	-31.0	1	20.626	-31.0

MODE= 3F, RPM= 1000, FREQUENCY=116.17 HZ (BLADE 8), 116.36 HZ (BLADE 5), DAMPING= 0.58 %

RECORD NO. 579 MUX 1 (BLD 8)			RECORD NO. 580 MUX 2 (BLD 8)			RECORD NO. 581 MUX 3 (BLD 8)			RECORD NO. 581 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.643	180.0	11	0.861	180.0	-	0.000	0.0	-	0.000	0.0
3	0.201	180.0	13	0.190	25.9	-	0.000	0.0	5	0.258	180.0
4	1.450	0.0	14	1.069	0.0	-	0.000	0.0	8	1.080	0.0
5	0.140	180.0	5	0.085	-18.5	5	0.146	-102.2	-	0.000	0.0
6	0.299	-85.4	15	0.539	0.0	-	0.000	0.0	9	0.235	-23.3
7	0.388	60.3	16	0.189	180.0	-	0.000	0.0	10	0.278	180.0
8	0.775	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.239	-40.9	9	0.183	-45.0	9	0.151	10.9	-	0.000	0.0
10	0.150	180.0	12	0.466	180.0	-	0.000	0.0	1	1.000	0.0
NF 1	10.749	-27.8	1	13.007	-18.6	1	11.088	98.8	1	14.400	-15.3

MODE= 1E, RPM= 1000, FREQUENCY= 22.74 HZ (BLADE 8), 22.80 HZ (BLADE 5), DAMPING= 0.77 %

RECORD NO. 582 MUX 1 (BLD 8)			RECORD NO. 583 MUX 2 (BLD 8)			RECORD NO. 584 MUX 3 (BLD 8)			RECORD NO. 584 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.048	-29.6	1	0.046	-27.9	1	0.047	-21.5	-	0.000	0.0
2	0.003	0.0	11	0.075	0.0	-	0.000	0.0	-	0.000	0.0
3	0.003	0.0	13	0.031	180.0	-	0.000	0.0	5	1.000	0.0
4	0.000	0.0	14	0.000	0.0	-	0.000	0.0	8	0.250	0.0
5	1.000	0.0	5	1.000	0.0	5	1.000	0.0	-	0.000	0.0
6	0.553	0.0	15	0.000	0.0	-	0.000	0.0	9	0.214	0.0
7	0.409	0.0	16	0.000	0.0	-	0.000	0.0	10	0.072	180.0
8	0.200	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.204	0.0	9	0.204	0.0	9	0.203	0.0	-	0.000	0.0
10	0.039	180.0	12	0.000	0.0	-	0.000	0.0	1	0.080	-14.3
NF 5	76.357	37.0	5	76.377	-99.2	5	73.423	-10.3	5	55.186	169.7

MODE= 1T, RPM= 1000, FREQUENCY= 40.47 HZ (BLADE 8), 40.51 HZ (BLADE 5), DAMPING= 1.53 %

RECORD NO. 585 MUX 1 (BLD 8)			RECORD NO. 586 MUX 2 (BLD 8)			RECORD NO. 587 MUX 3 (BLD 8)			RECORD NO. 587 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	0.052	64.1	1	0.086	60.5	1	0.045	106.6	-	0.000	0.0
2	0.026	99.9	11	0.292	0.0	-	0.000	0.0	-	0.000	0.0
3	0.030	73.7	13	0.098	-96.6	-	0.000	0.0	5	3.929	0.0
4	0.003	0.0	14	0.052	22.0	-	0.000	0.0	8	0.456	0.0
5	3.728	0.0	5	3.850	-12.4	5	3.332	110.1	-	0.000	0.0
6	2.279	0.0	15	0.127	180.0	-	0.000	0.0	9	1.000	0.0
7	1.763	0.0	16	0.022	180.0	-	0.000	0.0	10	0.187	-73.5
8	0.617	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	1.003	0.0	9	1.000	0.0	9	1.000	0.0	-	0.000	0.0
10	0.119	180.0	12	0.338	180.0	-	0.000	0.0	1	0.159	180.0
NF 9	10.222	18.5	9	8.467	173.4	9	10.634	125.2	9	6.976	125.2

TABLE 36 EFFECT OF ROTOR CONFIGURATION AND SPEED ON FREQUENCY OF FIRST BENDING MODE OF BLADE S/N 8

– = not available

Configuration				Frequency, Hz (speed, rpm)				
Flex	Pitch	Precone	Droop					
Stiff	0	0	0	5.21 (0)	9.53 (400)	12.75 (600)	16.30 (800)	19.52 (1000)
	12	0	0	-	-	13.52 (650)	-	18.98 (1000)
	0	0	-5	5.21 (0)	-	-	-	19.37 (1000)
	12	0	-5	5.19 (0)	-	-	-	18.73 (1000)
	0	5	0	5.19 (0)	-	-	-	20.32 (1000)
	12	5	0	5.17 (0)	-	-	-	18.71 (1000)
Soft	0	0	0	5.19 (0)	-	-	15.46 (775)	19.37 (1000)
	0	0	-5	5.18 (0)	9.38 (410)	-	14.19 (710)	19.48 (1012)
	12	0	-5	5.17 (0)	-	-	-	18.50 (1000)
	-12	0	-5	5.18 (0)	-	-	-	18.70 (1000)
	0	5	0	5.19 (0)	-	-	-	19.33 (1000)
	12	5	0	5.18 (0)	-	-	-	18.42 (1000)

TABLE 37 EFFECT OF ROTOR CONFIGURATION AND SPEED ON FREQUENCY OF SECOND BENDING MODE OF BLADE S/N 8

- = not available

Flex	Configuration Pitch	Precone	Droop	Frequency, Hz (speed, rpm)				
Stiff	0	0	0	32.17 (0)	-	41.15 (600)	49.37 (800)	55.94 (1000)
	12	0	0	-	-	44.76 (680)	-	54.34 (1000)
	0	0	-5	32.36 (0)	-	-	-	55.30 (1010)
	12	0	-5	32.32 (0)	-	-	-	55.15 (1000)
	0	5	0	32.28 (0)	-	-	-	55.12 (1000)
	12	5	0	32.22 (0)	-	-	-	54.62 (1000)
Soft	0	0	0	32.20 (0)	-	-	47.06 (775)	54.72 (1000)
	0	0	-5	32.05 (0)	-	-	45.17 (710)	55.58 (1012)
	12	0	-5	-	-	-	-	55.24 (1000)
	-12	0	-5	32.19 (0)	-	-	-	55.17 (1000)
	0	5	0	32.17 (0)	-	-	-	54.83 (1000)
	12	5	0	32.16 (0)	-	-	-	52.64 (1000)

TABLE 38 EFFECT OF ROTOR CONFIGURATION AND SPEED ON FREQUENCY OF THIRD BENDING MODE OF BLADE S/N 8

- = not available

	Configuration			Frequency, Hz (speed, rpm)				
Flex	Pitch	Precone	Droop					
Stiff	0	0	0	91.80 (0)	95.88 (400)	102.05 (600)	109.29 (800)	117.37 (1000)
	12	0	0	-	-	103.51 (680)	-	117.10 (1000)
	0	0	-5	91.31 (0)	-	-	-	114.34 (950)
	12	0	-5	91.23 (0)	-	-	-	117.03 (1000)
	0	5	0	90.58 (0)	-	-	-	116.72 (1000)
	12	5	0	90.62 (0)	-	-	-	117.04 (1000)
Soft	0	0	0	90.58 (0)	-	-	-	115.83 (1000)
	0	0	-5	90.22 (0)	-	-	-	116.85 (1012)
	12	0	-5	90.32 (0)	-	-	-	116.39 (1000)
	-12	0	-5	90.31 (0)	-	-	-	116.17 (1000)
	0	5	0	90.69 (0)	-	-	-	116.91 (1000)
	12	5	0	90.32 (0)	-	-	-	110.74 (1000)

TABLE 39 EFFECT OF ROTOR CONFIGURATION AND SPEED ON FREQUENCY OF FIRST EDGEWISE MODE OF BLADE S/N 8

- = not available

	Configuration			Frequency, Hz (speed, rpm)				
Flex	Pitch	Precone	Droop					
Stiff	0	0	0	24.02 (0)	24.31 (400)	24.51 (650)	24.72 (800)	25.09 (1000)
	12	0	0	-	-	24.53 (680)	-	25.31 (1000)
	0	0	-5	23.91 (0)	-	-	-	24.46 (950)
	12	0	-5	23.68 (0)	-	-	-	24.83 (1000)
	0	5	0	23.78 (0)	-	-	-	24.50 (1000)
	12	5	0	23.63 (0)	-	-	-	24.79 (1000)
Soft	0	0	0	22.03 (0)	-	-	-	22.51 (1000)
	0	0	-5	19.98 (0)	21.16 (410)	21.82 (710)	-	22.25 (1012)
	12	0	-5	19.98 (0)	-	-	-	22.74 (1000)
	-12	0	-5	20.04 (0)	-	-	-	22.74 (1000)
	0	5	0	21.91 (0)	-	-	-	21.35 (1000)
	12	5	0	21.83 (0)	-	-	-	21.99 (1000)

TABLE 40 EFFECT OF ROTOR CONFIGURATION AND SPEED ON FREQUENCY OF FIRST TORSION MODE OF BLADE S/N 8

– = not available

Configuration				Frequency, Hz (speed, rpm)				
Flex	Pitch	Precone	Droop					
Stiff	0	0	0	43.61 (0)	45.00 (400)	44.51 (650)	48.50 (800)	47.93 (1000)
	12	0	0	–	–	46.14 (680)	–	47.57 (1000)
	0	0	-5	44.24 (0)	–	–	–	53.87 (950)
	12	0	-5	44.19 (0)	–	–	–	49.49 (1000)
	0	5	0	44.14 (0)	–	–	–	48.64 (1000)
	12	5	0	43.95 (0)	–	–	–	50.27 (1000)
Soft	0	0	0	37.96 (0)	–	–	41.26 (775)	44.10 (1000)
	0	0	-5	37.75 (0)	–	–	–	40.63 (1012)
	12	0	-5	37.81 (0)	–	–	–	40.17 (1000)
	-12	0	-5	37.94 (0)	–	–	–	40.47 (1000)
	0	5	0	39.01 (0)	–	–	–	38.60 (1000)
	12	5	0	37.89 (0)	–	–	–	38.10 (1000)

TABLE 41 SAMPLING RATE AND BANDPASS FILTER ASSIGNMENTS

Excitation Frequency Hz	Sampling Rate samples/sec	Frequency Resolution Hz	Bandpass Filter Hz
0 - 10	100	0.1	fe ± 2
10 - 20	200	0.2	fe ± 3
20 - 30	400	0.4	fe ± 4
30 - 50	1000	1.0	fe ± 5
50 - 150	2000	2.0	fe ± 8
150 - 300	4000	4.0	fe ± 10

Note: fe = excitation frequency in Hz

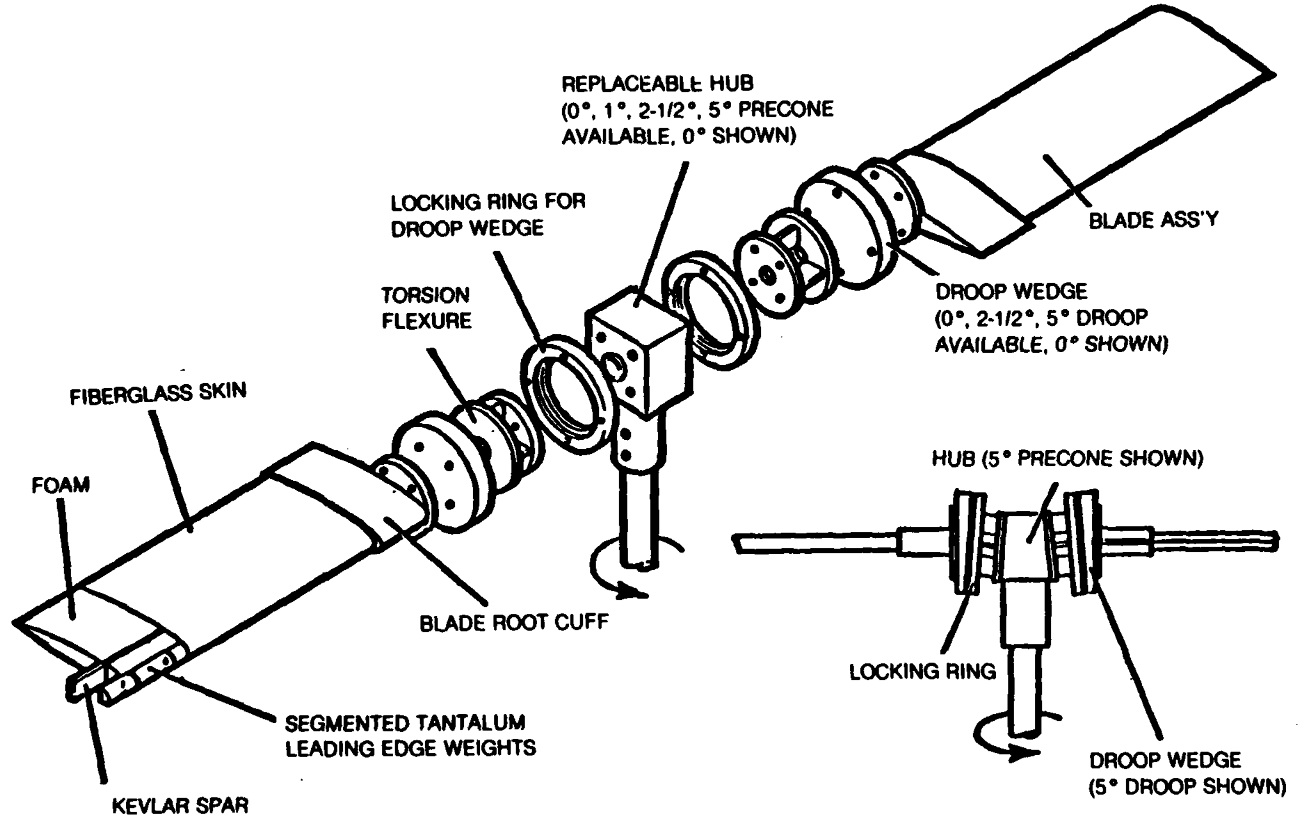


Figure 1 Schematic of Selected Hingless Helicopter Rotor Model-ITR Study Configuration II-A

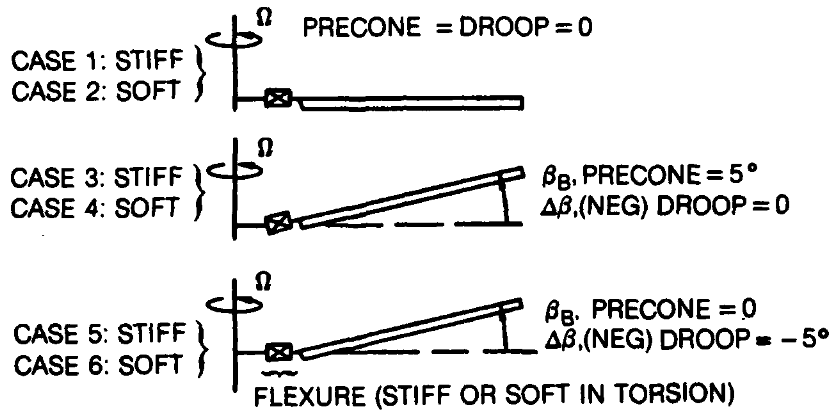


Figure 2 Rotor Configuration Cases Selected for Tests

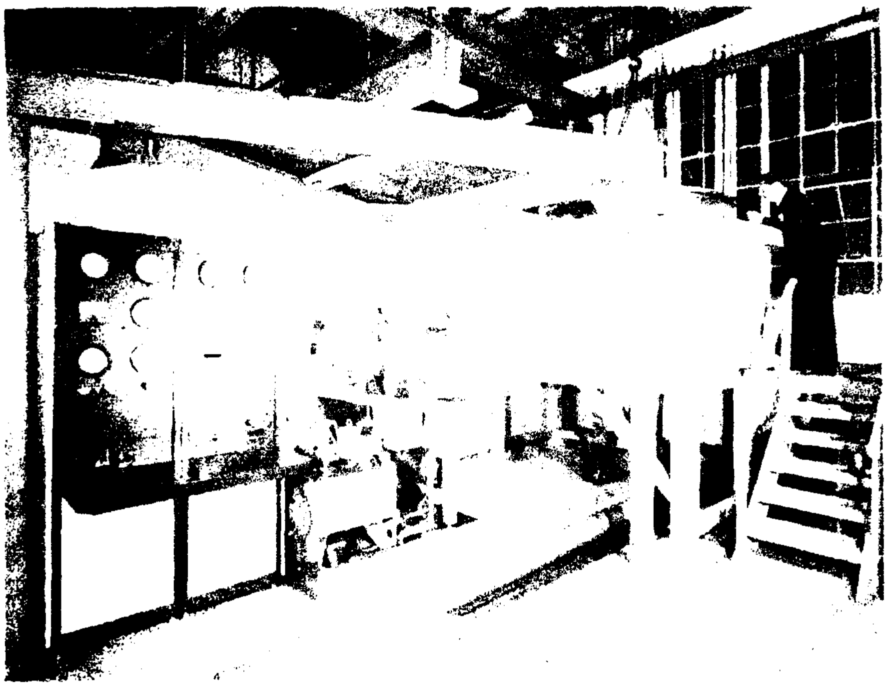


Figure 3 UTRC Vacuum Spin Rig

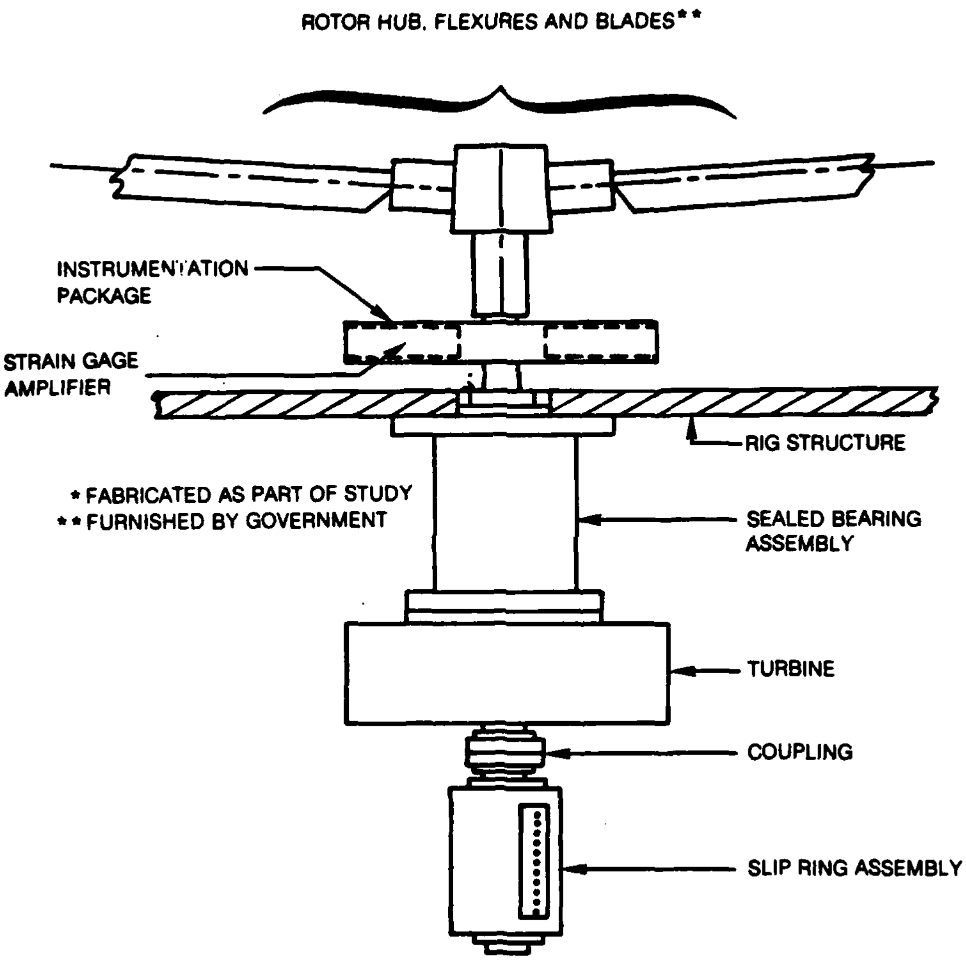


Figure 4 Conceptual Arrangement for Model Installation in the Vacuum Spin Rig

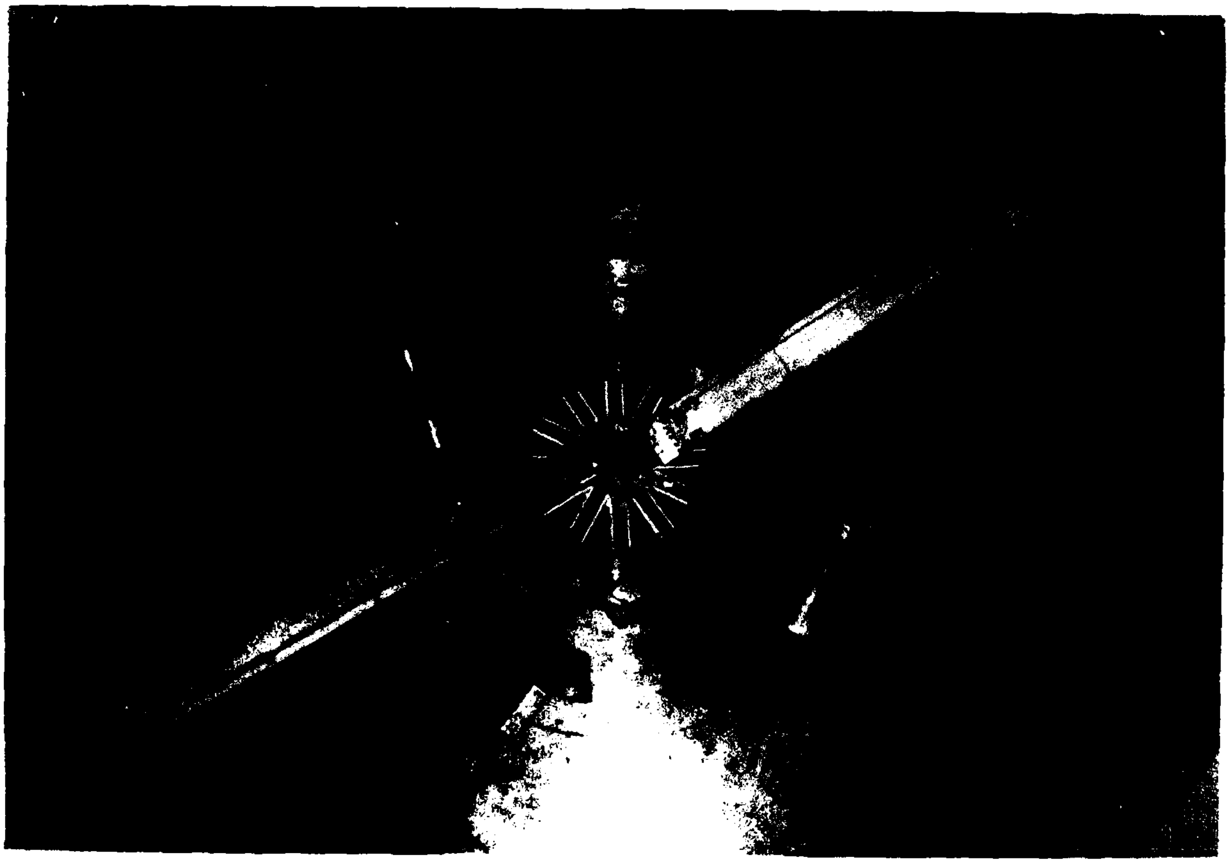


Figure 5 Instrumented Model Rotor in the UTRC Spin Rig

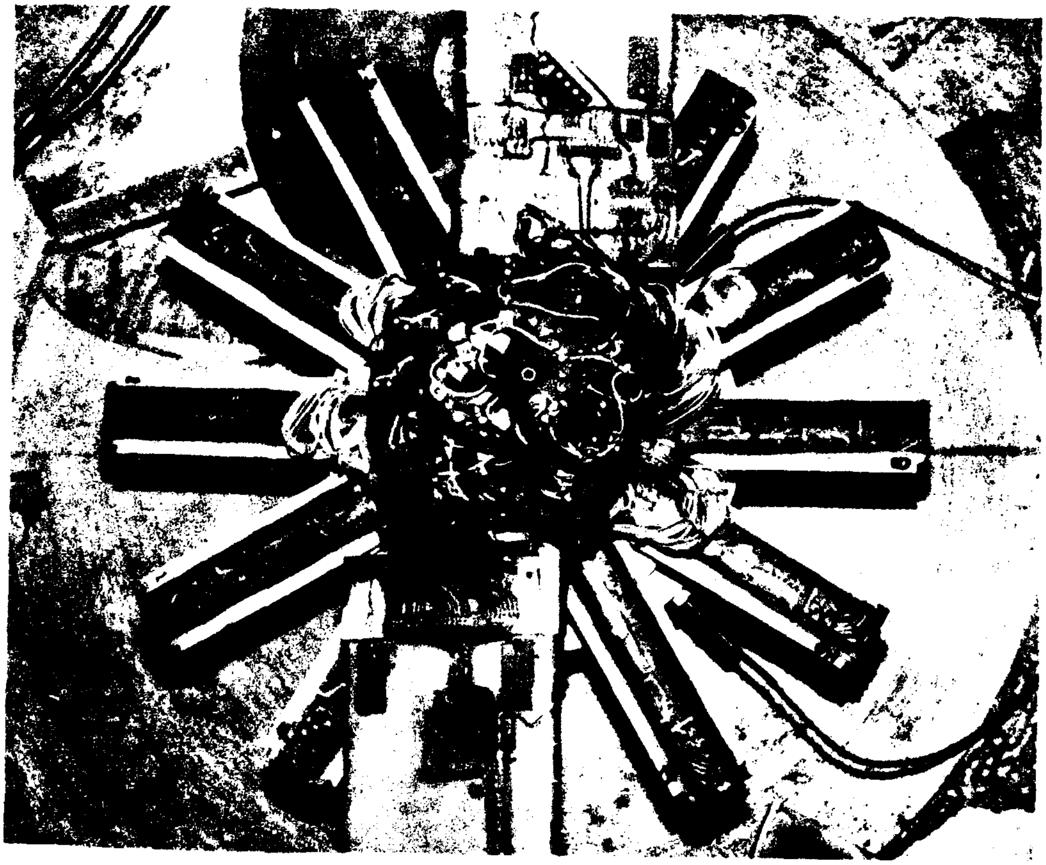
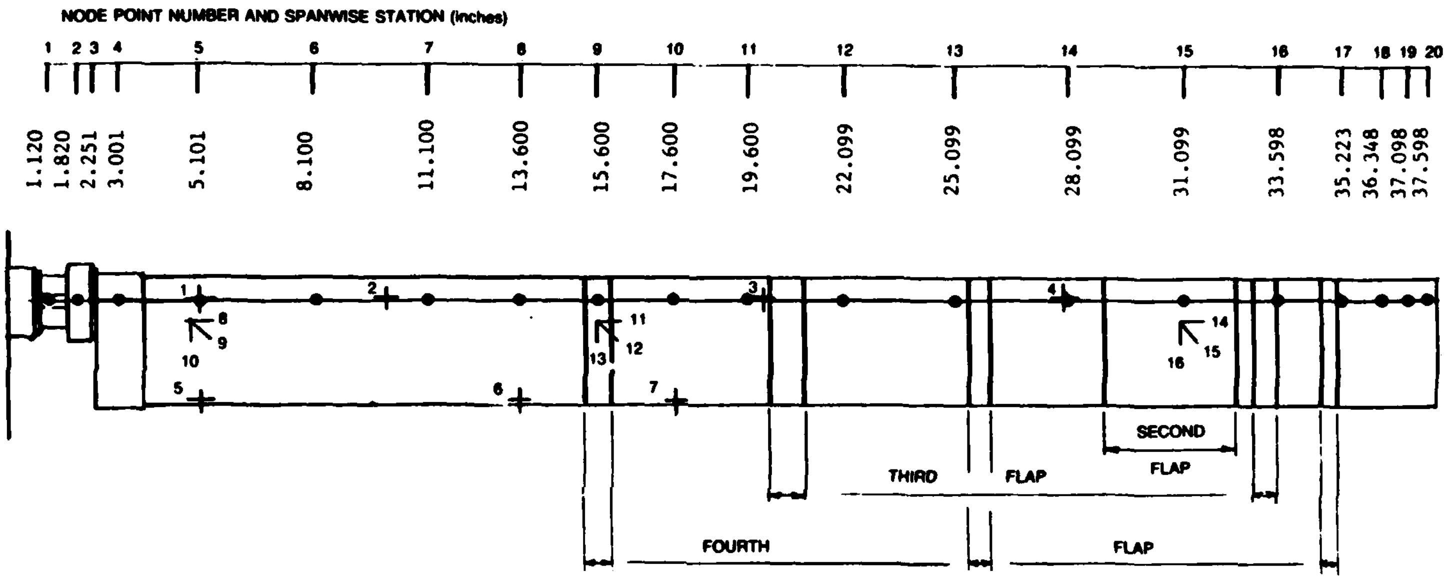


Figure 6 Model Rotor Drive Crystal Arrangement



GAGE #	DIRECTION	CONNECTION	NOTES
1 - 4	RADIAL	HALF BRIDGE	GAGES ON BOTH SURFACES - WIRING ON LOWER
5 - 7	RADIAL	QUARTER BRIDGE	GAGES AND WIRING ON LOWER SURFACE
8 - 16	45° RECT ROSETTE	QUARTER BRIDGE	GAGES AND WIRING ON UPPER SURFACE

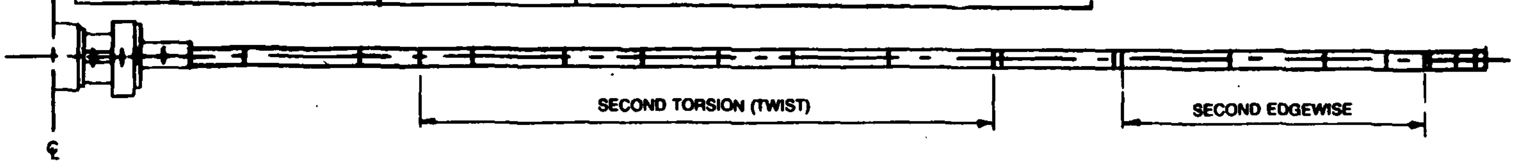


Figure 7 Strain Gage Description and Locations Relative to Component Mode Node Line Excursions for all Configurations and Speeds

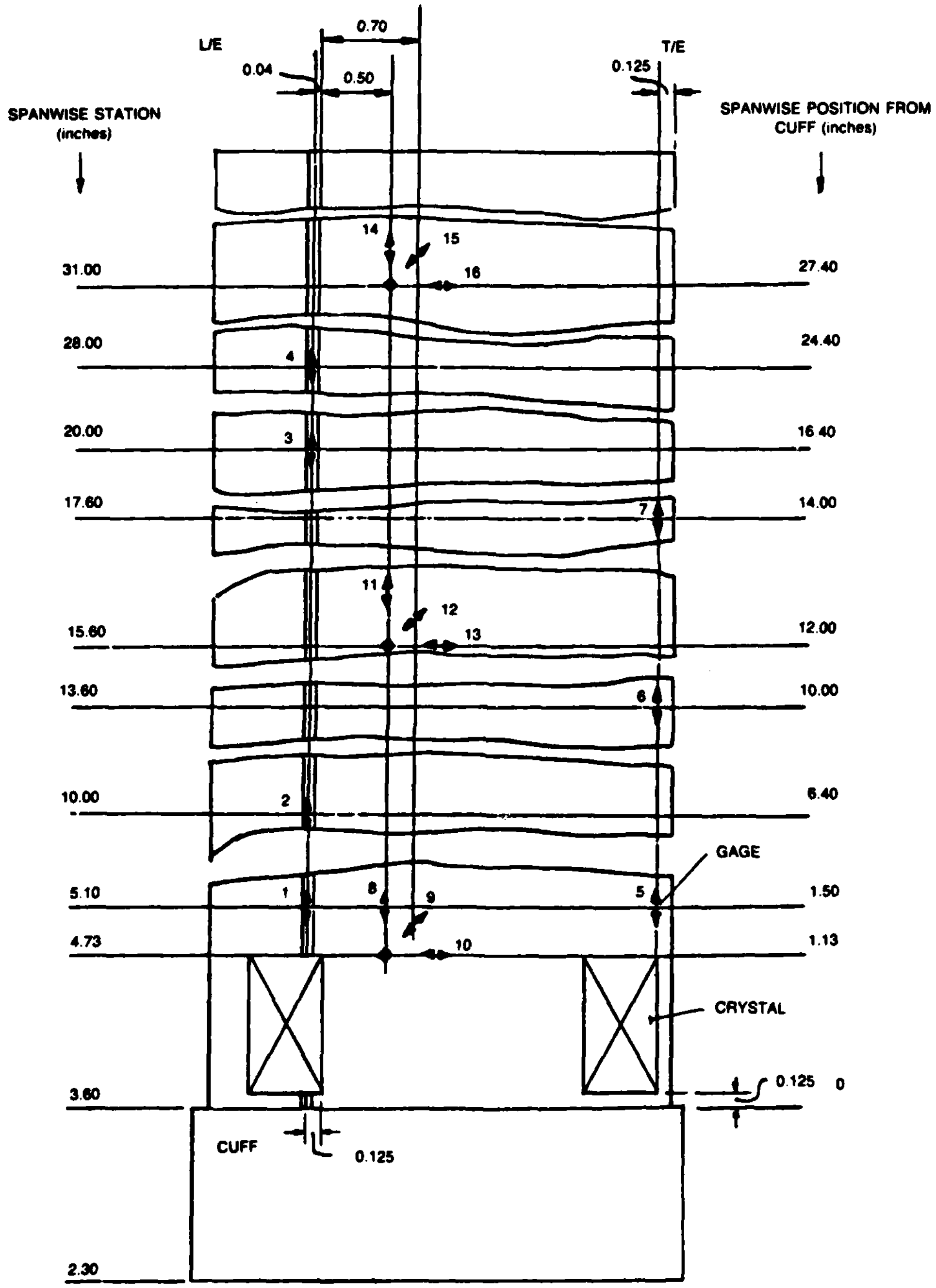


Figure 8 Strain Gage and Crystal Locations on Blade S/N 8

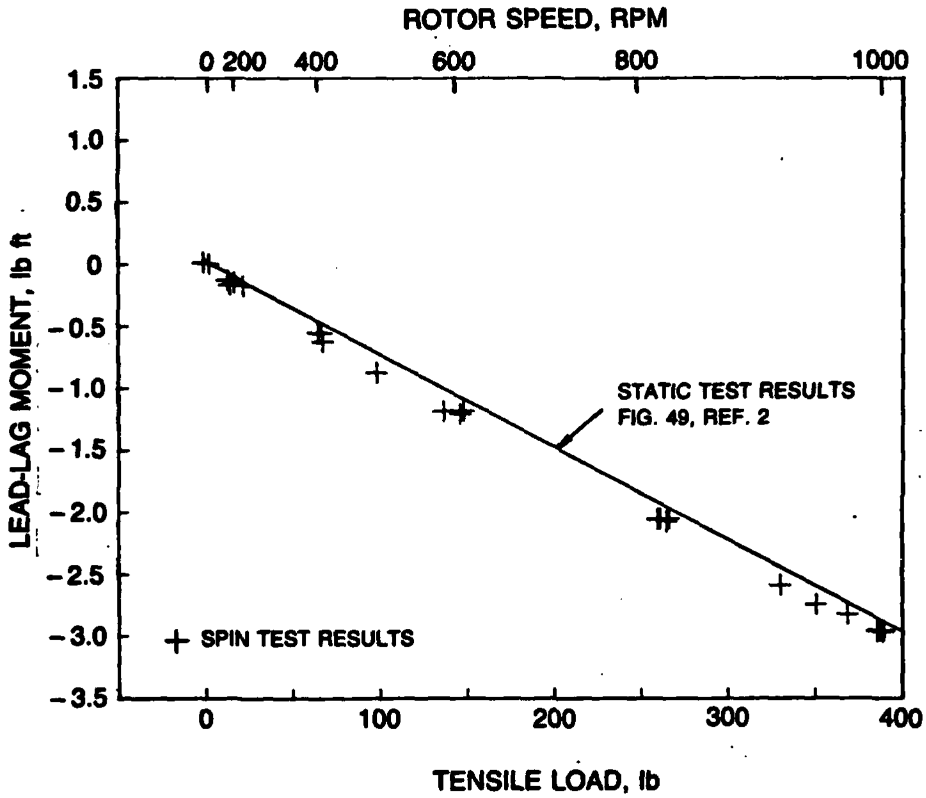


Figure 9 Comparison Between Steady Lead-Lag Moments Measured at Various Speeds with those Measured in Static Tests

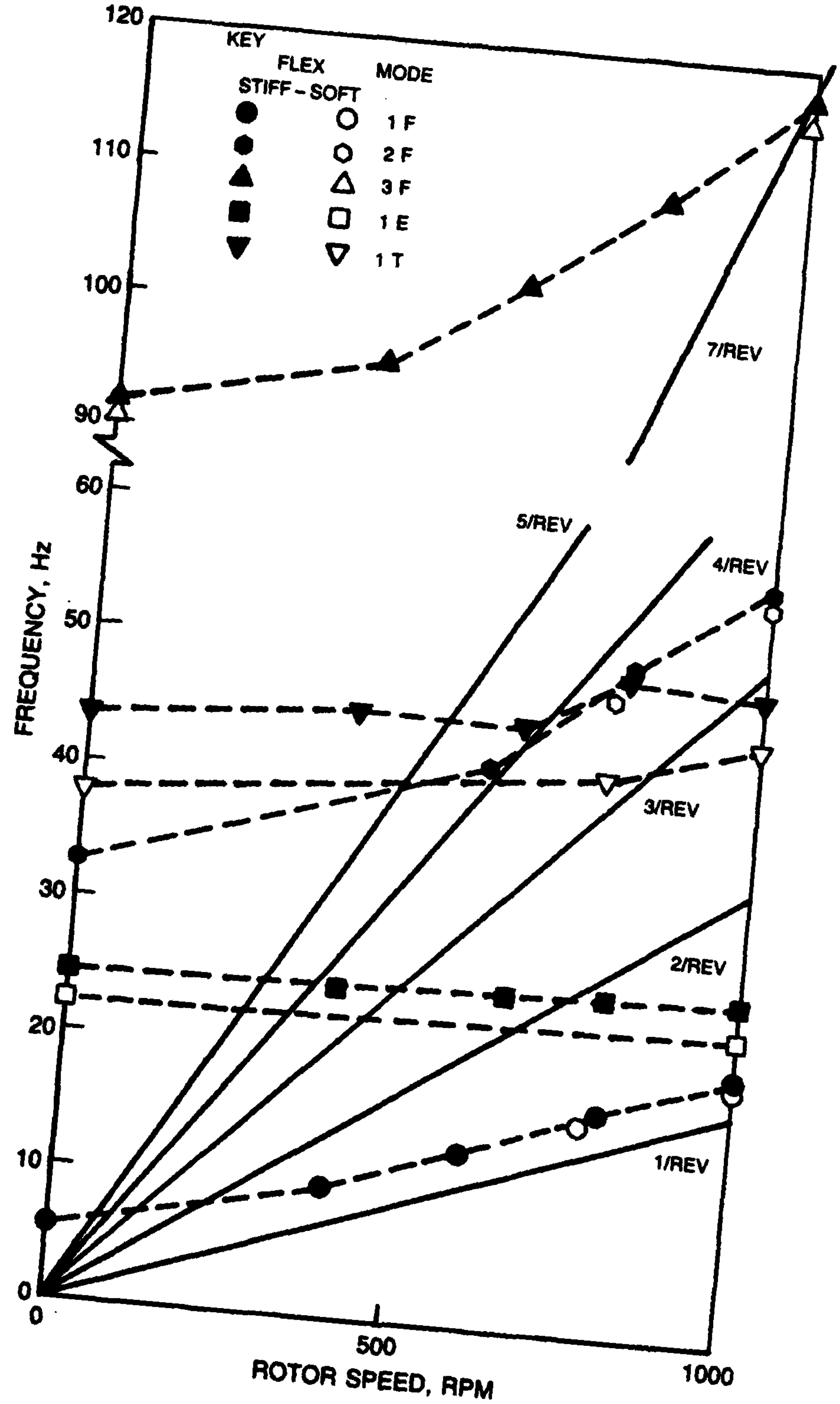


Figure 10 Effect of Rotor Speed on Modal Frequencies for Rotor Configurations 1 (a) and 2

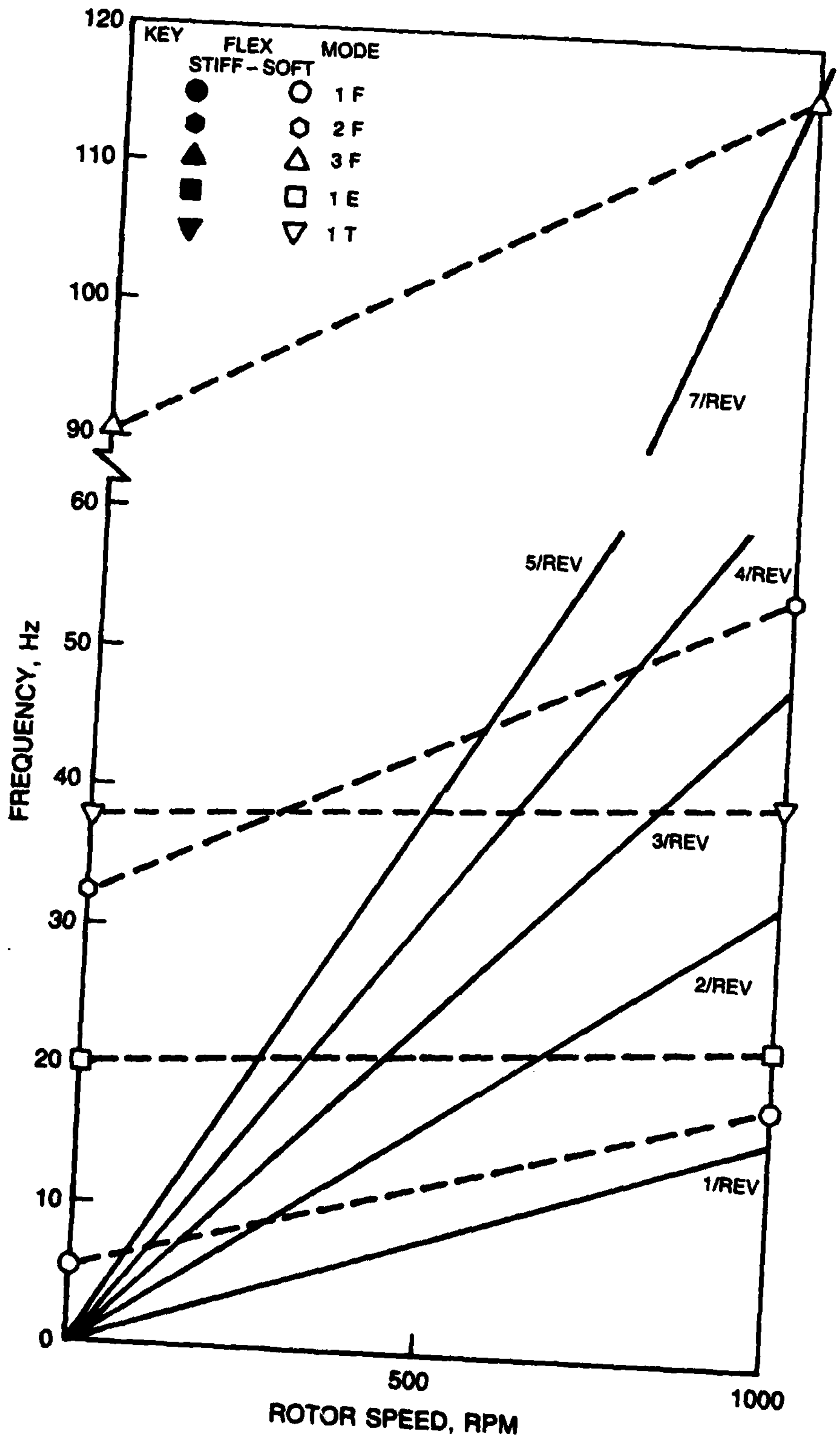


Figure 11 Effect of Rotor Speed on Modal Frequencies for Rotor Configuration 6 (c)

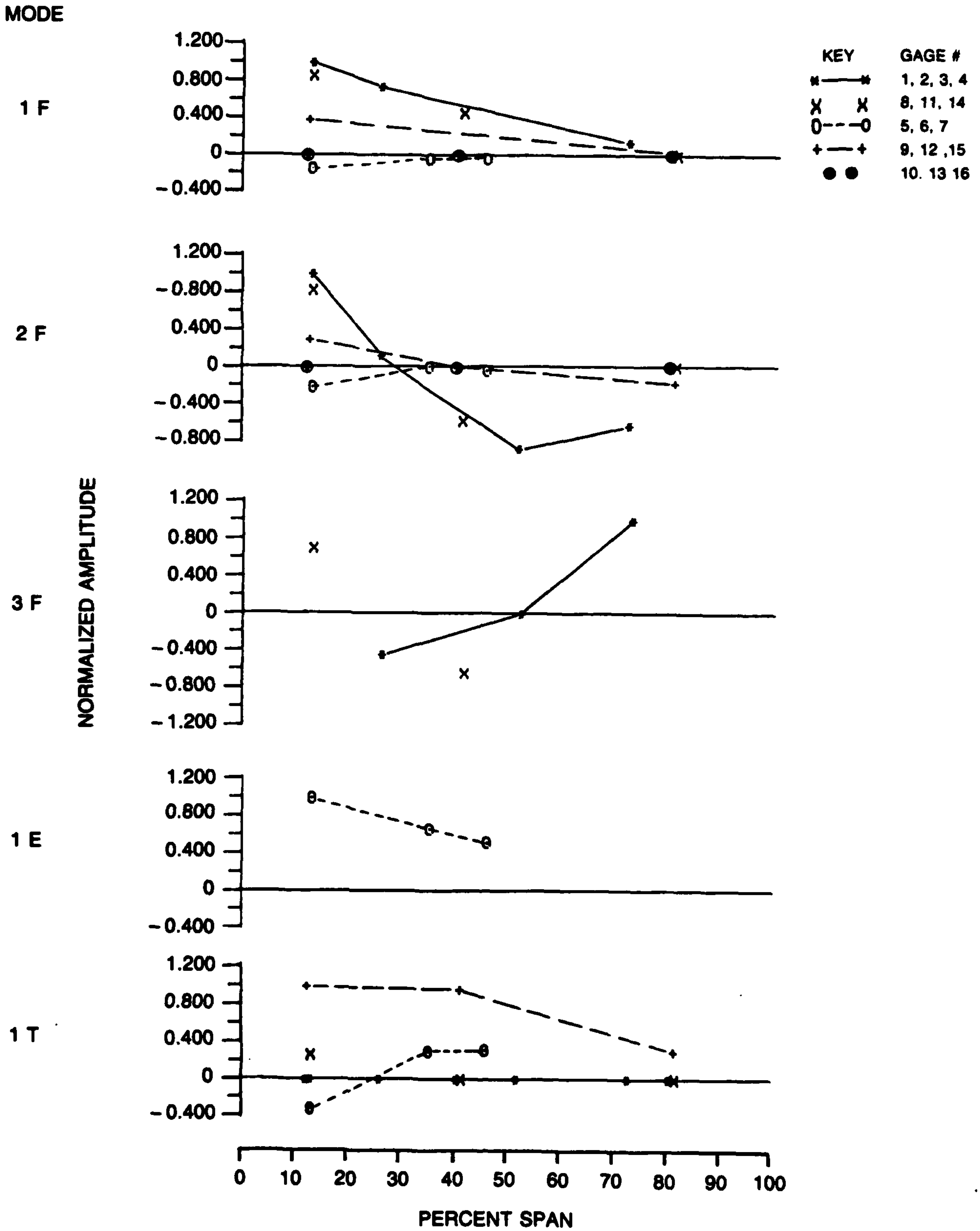


Figure 12 Modal Amplitude Plots for Rotor Configuration 1 (a) at 0 RPM

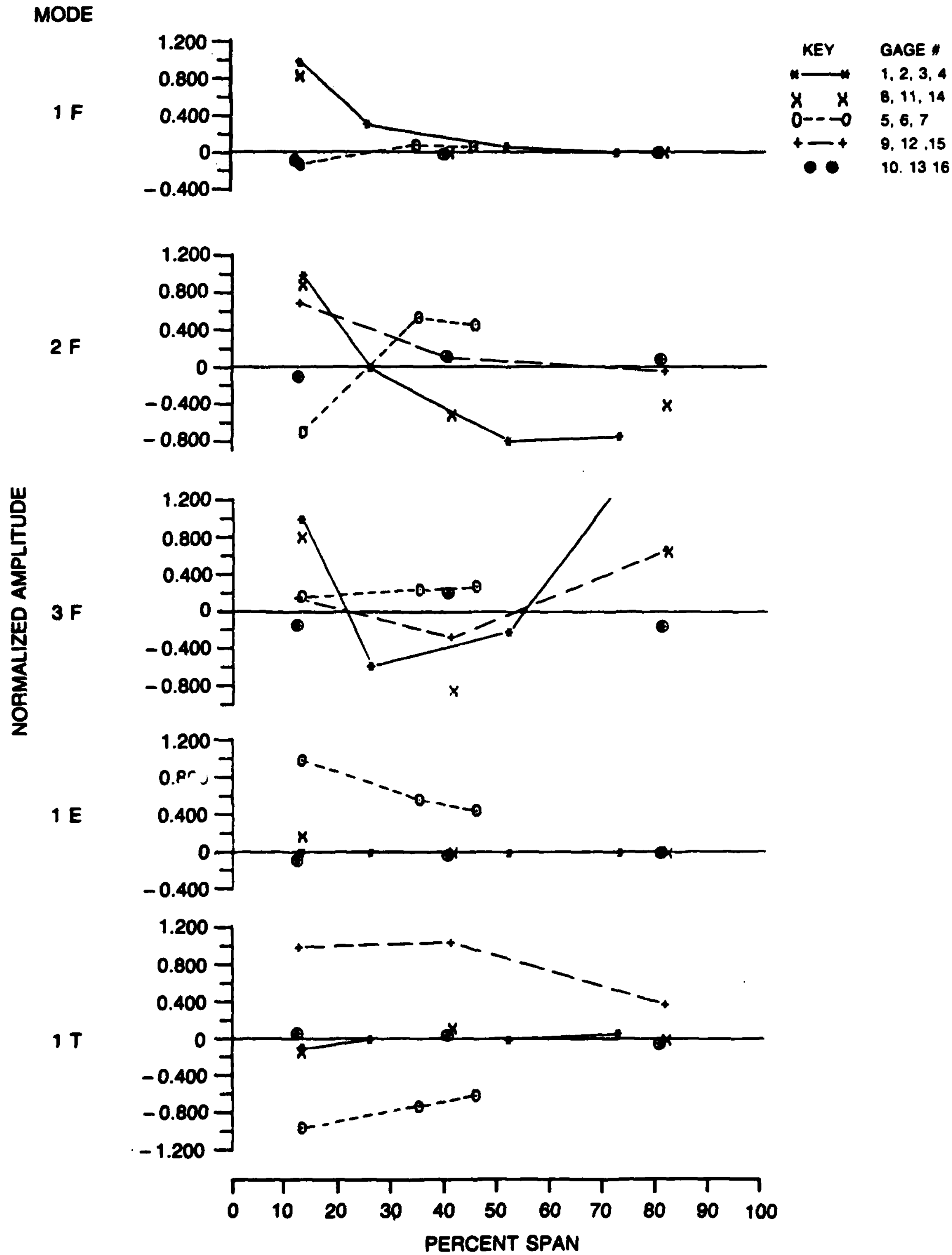


Figure 13 Modal Amplitude Plots for Rotor Configuration 1 (a) at 1000 RPM

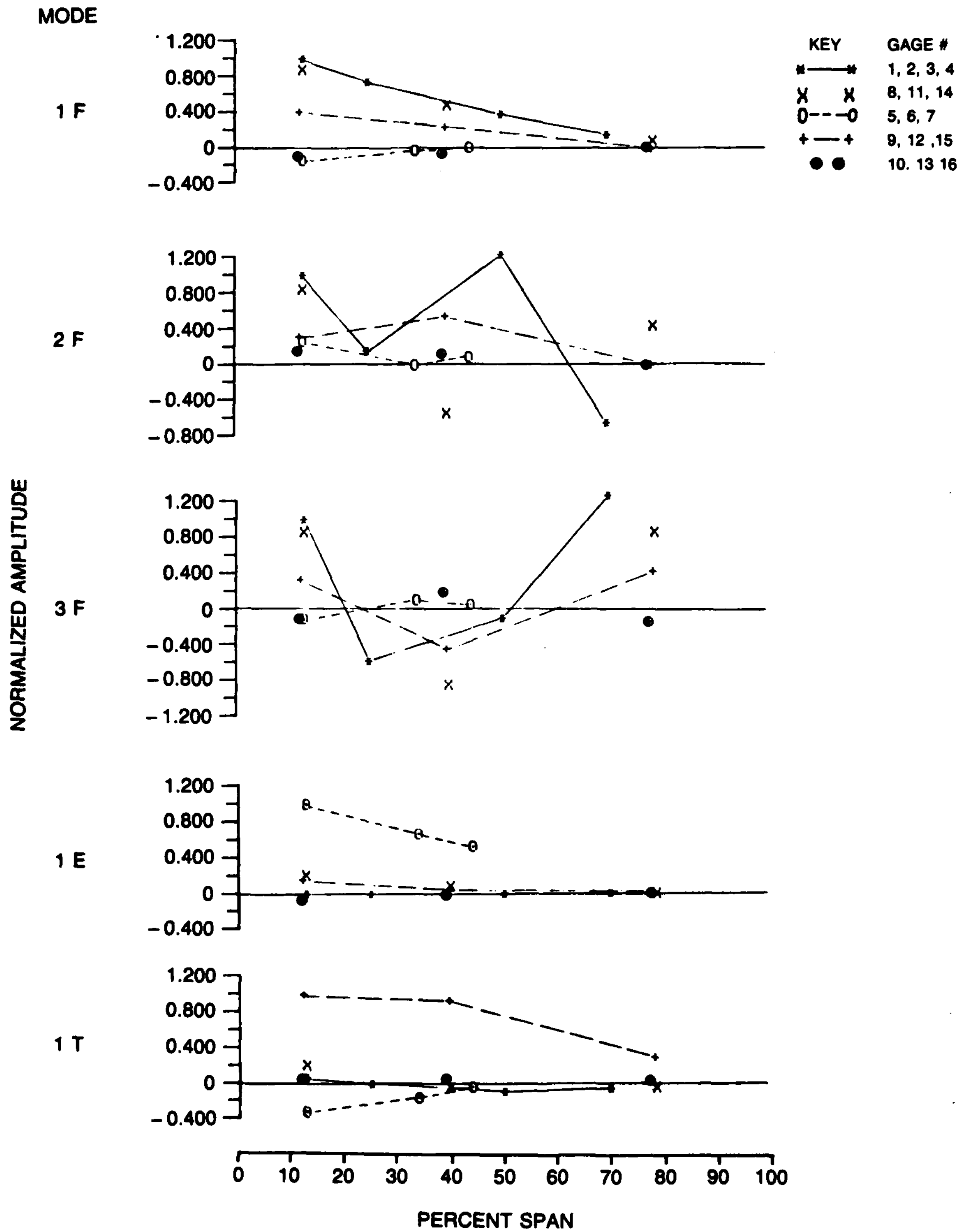


Figure 14 Modal Amplitude Plots for Rotor Configuration 2 and 0 RPM

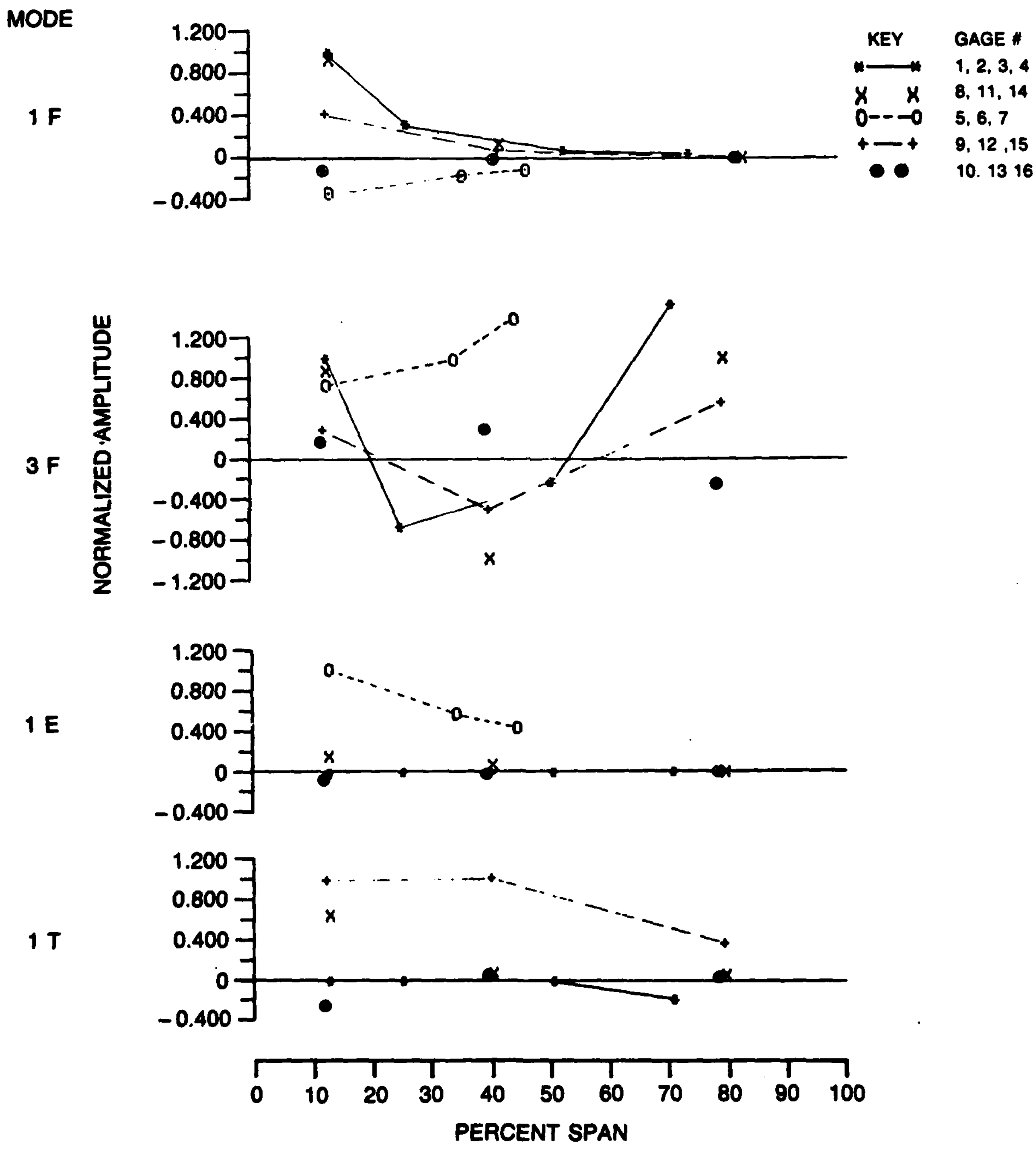


Figure 15 Modal Amplitude Plots for Rotor Configuration 2 at 1000 RPM

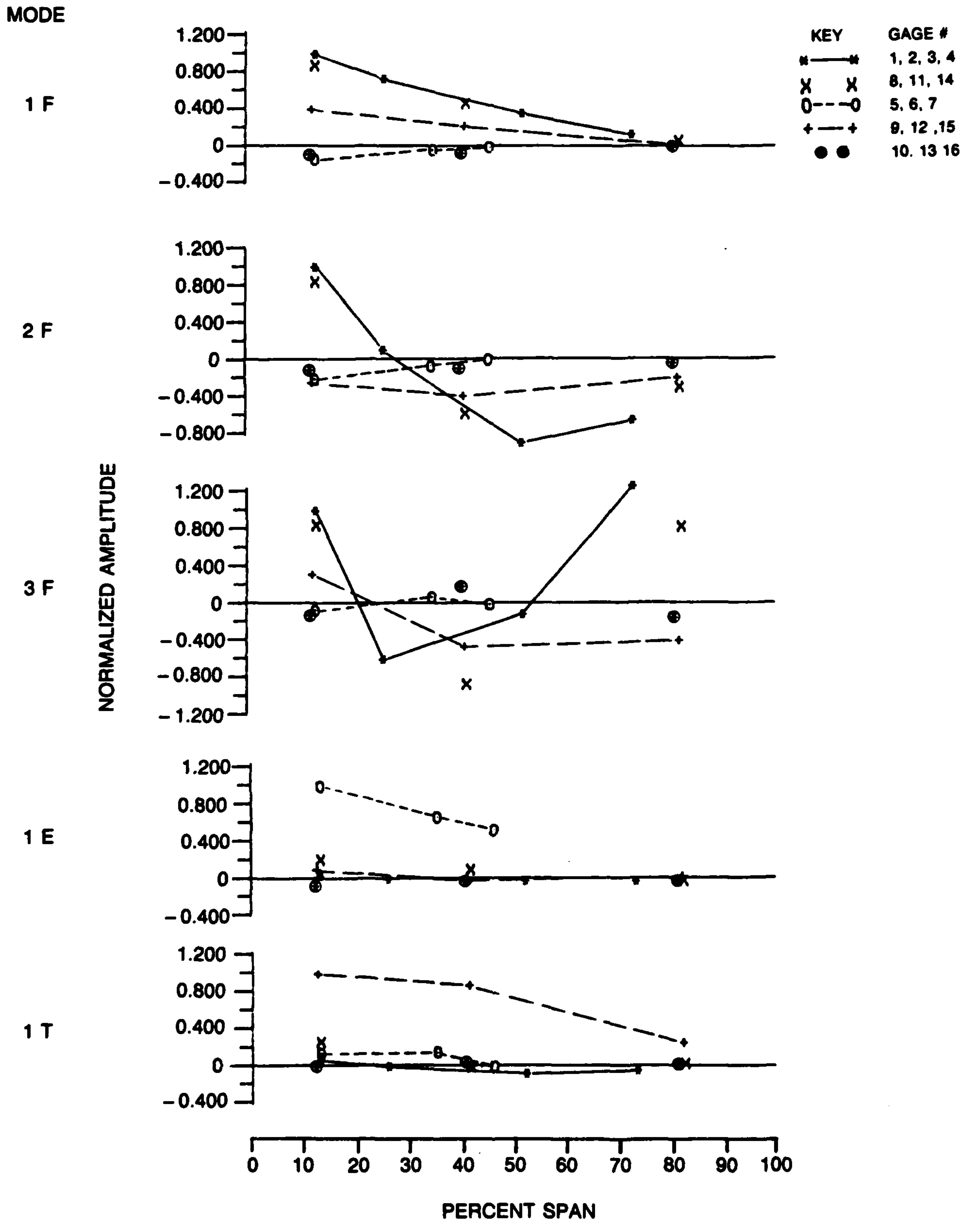


Figure 16 Modal Amplitude Plots for Rotor Configuration 6 (c) at 0 RPM

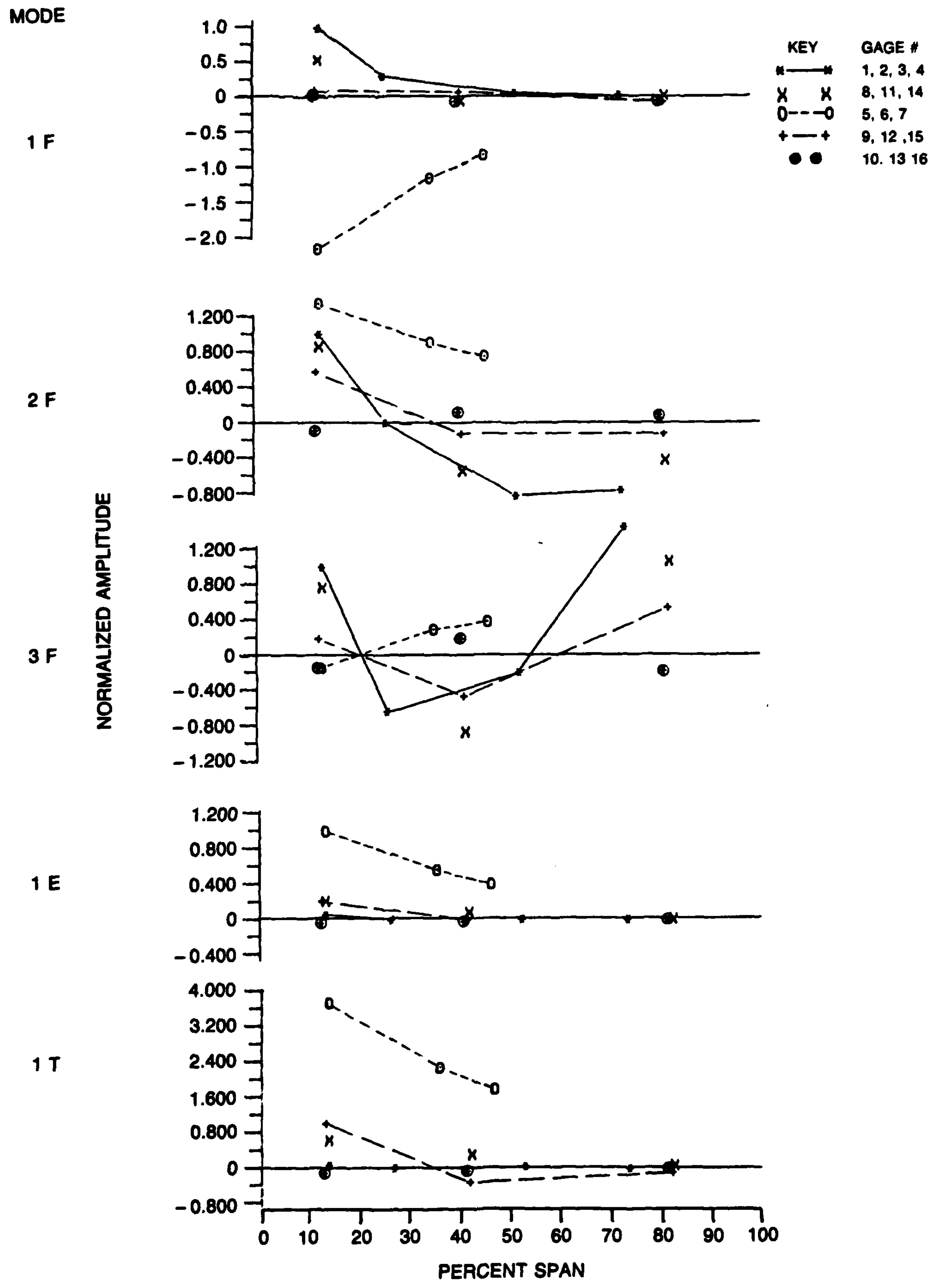


Figure 17 Modal Amplitude Plots for Rotor Configuration 6 (c) at 1000 RPM

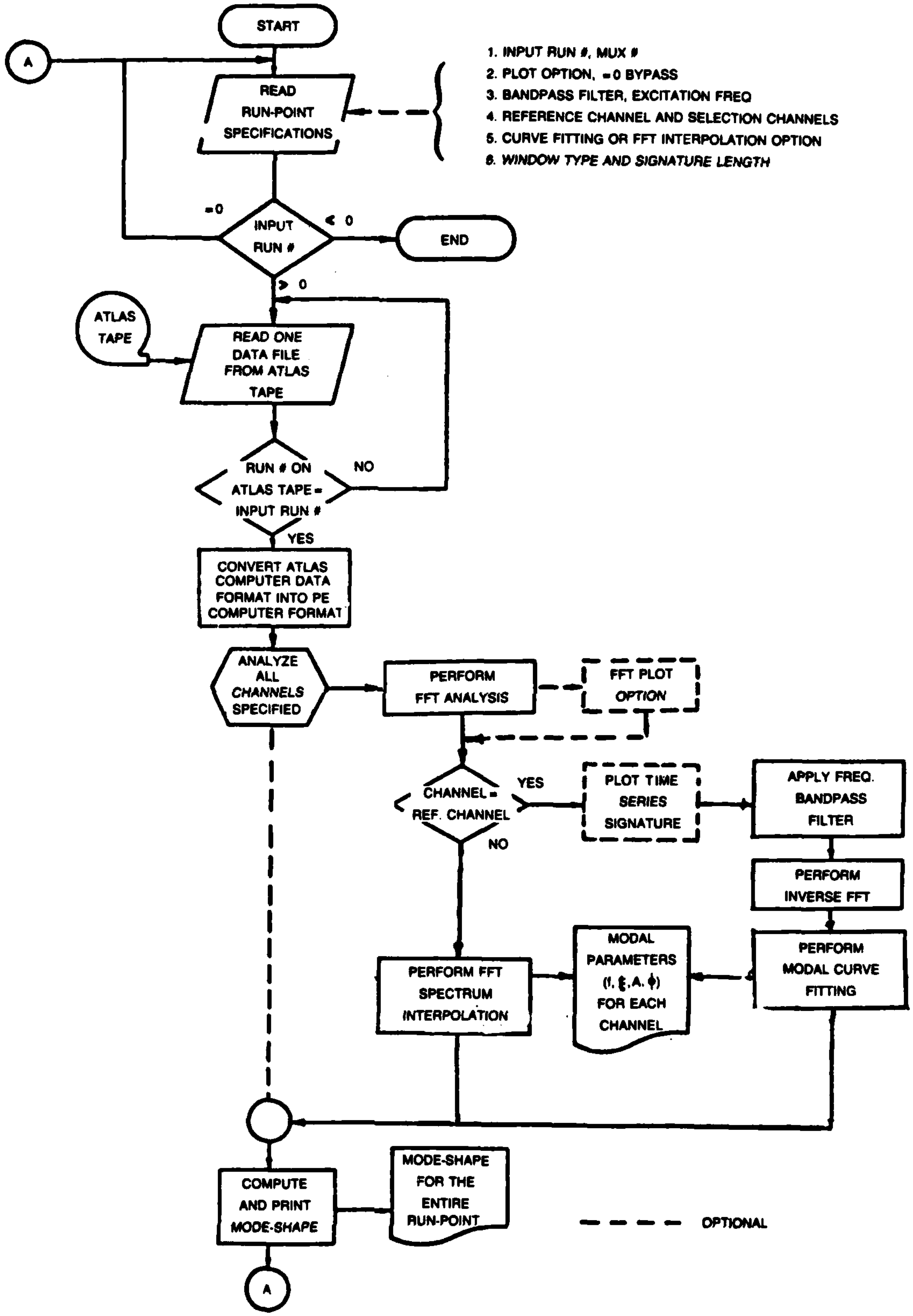


Figure 18 Data Reduction Program Logic Diagram

Given a set of digitized time domain signature:

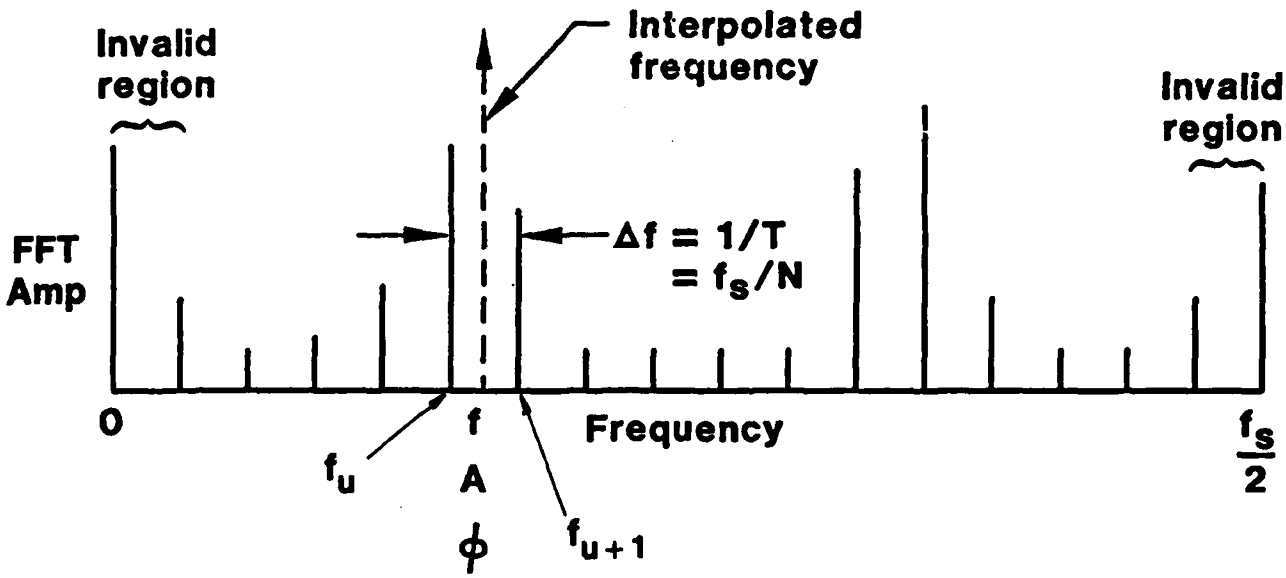
$$X(t_j),\ j = 1, \ldots N$$

Assume an analytical wave form

$$Y(t_j) = \sum_{m=1}^{NM} \exp(\xi_m t_j)\,[A_m \sin(2\pi f_m t_j) + B_m \cos(2\pi f_m t_j)],\ j = 1, \ldots N$$

Minimize $$\sum_{j=1}^{N} [Y(t_j) - X(t_j)]^2$$

Figure 19 Time Domain Modal Curve Fit Algorithm



$$X(t_j) = A \bullet \cos\,[2\pi f\ (t_j) + \phi] \qquad j = 0, \ldots N-1$$

$$M_u e^{i\phi_u} = \mathrm{FFT}\ [X\ (t_j)] \qquad u = 0, \ldots (N/2-1)$$

Assume $f_u \leq f \leq f_{u+1}$ $\quad \Delta f = f_{u+1} - f_u \qquad \nu = \dfrac{M_{u+1}}{M_{u+1} + M_u}$

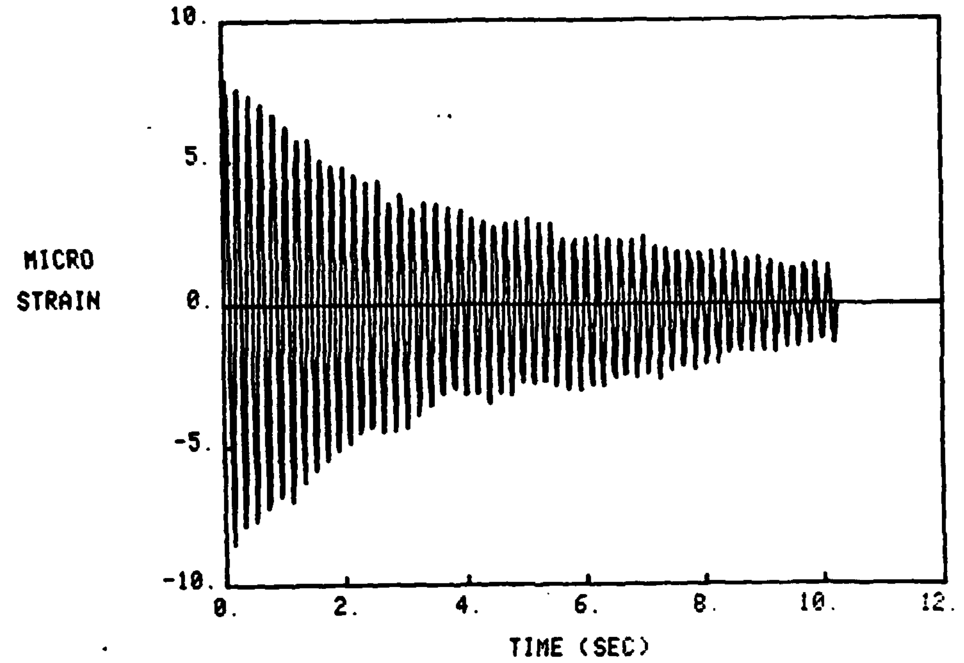
$0 \leq \nu \leq 1/2$	$1/2 < \nu \leq 1$
$f = f_u + \nu\Delta f$ $A \cong \pi\nu M_u / \sin(\pi\nu)$ $\phi = \phi_u - \pi\nu\ (N{\cdot}1)/N$	$f = f_{u+1} - (1-\nu)\,\Delta f$ $A \cong \pi\ (1-\nu)\ M_{u+1} / \sin(\pi - \pi\nu)$ $\phi \cong \phi_{u+1} + \pi\ (1-\nu)\ (N-1)/N$

Figure 20 FFT Spectrum Interpolation Formulas

```
IRUN=588,IMUX=1,IPLT=0,HURZ=5.,FILTER=3.,7.,NM=1,NREF=1,
      NPTCF=400,IOPT=2,INTP=1,IWD=0,ICHL=1,2,3,4,5,6,7,8,9,10,4*0,/
IRUN=589,IMUX=2,IPLT=0,HURZ=5.,FILTER=3.,7.,NM=1,NREF=1,
      NPTCF=400,IOPT=2,INTP=1,IWD=0,ICHL=1,2,3,4,5,6,7,0,9,10,4*0,/
IRUN=590,IMUX=3,IPLT=0,HURZ=5.,FILTER=3.,7.,NM=1,NREF=1,
      NPTCF=400,IOPT=2,INTP=1,IWD=0,ICHL=1,0,3,4,5,6,7,0,9,10,4*0,/
IRUN=591,IMUX=1,IPLT=0,HURZ=32.,FILTER=27.,37.,NM=1,NREF=1,
      NPTCF=400,IOPT=2,INTP=1,IWD=0,ICHL=1,2,3,4,5,6,7,8,9,10,4*0,/
IRUN=592,IMUX=2,IPLT=0,HURZ=32.,FILTER=27.,37.,NM=1,NREF=1,
      NPTCF=400,IOPT=2,INTP=1,IWD=0,ICHL=1,2,3,4,5,6,7,0,9,10,4*0,/
IRUN=593,IMUX=3,IPLT=0,HURZ=32.,FILTER=27.,37.,NM=1,NREF=1,
      NPTCF=400,IOPT=2,INTP=1,IWD=0,ICHL=1,0,3,4,5,6,7,0,9,10,4*0,/
IRUN=594,IMUX=1,IPLT=0,HURZ=90.,FILTER=82.,98.,NM=1,NREF=1,
      NPTCF=400,IOPT=2,INTP=1,IWD=0,ICHL=1,2,3,4,5,6,7,8,9,10,4*0,/
IRUN=595,IMUX=2,IPLT=0,HURZ=90.,FILTER=82.,98.,NM=1,NREF=1,
      NPTCF=400,IOPT=2,INTP=1,IWD=0,ICHL=1,2,3,4,5,6,7,0,9,10,4*0,/
IRUN=596,IMUX=3,IPLT=0,HURZ=90.,FILTER=82.,98.,NM=1,NREF=1,
      NPTCF=400,IOPT=2,INTP=1,IWD=0,ICHL=1,0,3,4,5,6,7,0,9,10,4*0,/
IRUN=597,IMUX=1,IPLT=0,HURZ=22.,FILTER=18.,26.,NM=1,NREF=5,
      NPTCF=400,IOPT=2,INTP=1,IWD=0,ICHL=1,2,3,4,5,6,7,8,9,10,4*0,/
```

Figure 21 Sample Input Data File

RUN=588, CHANNEL= 1, DATE= 608, MODE= 1, VACUUM= 0, RPM= 0
SAMPLING RATE 100., PITCH= 0, PRECONE= 0, DROOP= 0



FFT MAGNITUDE FOR RUN NO. 588, CHANNEL 1

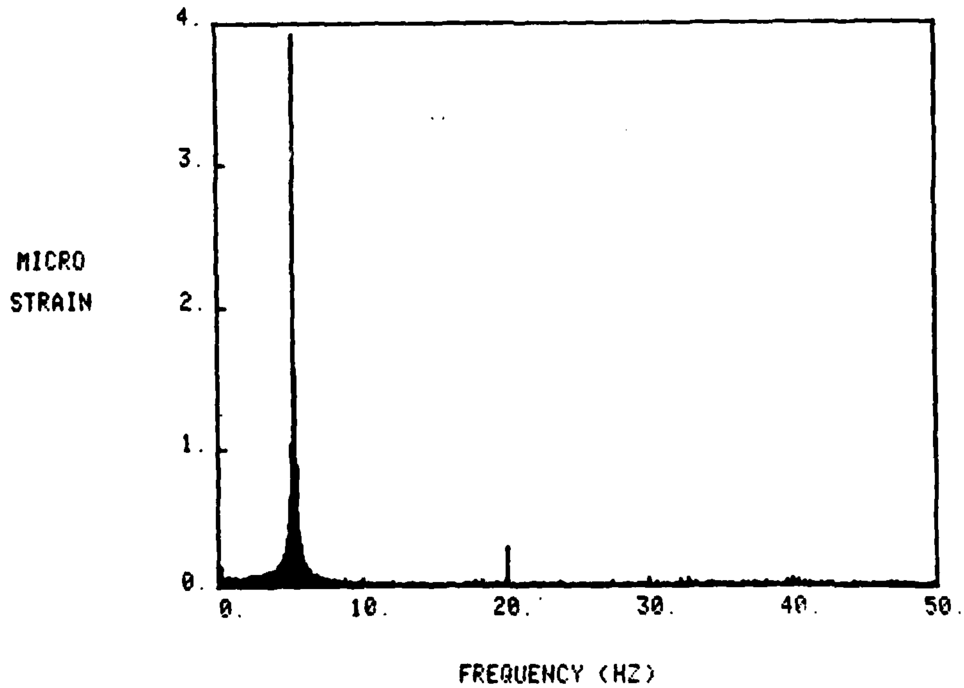
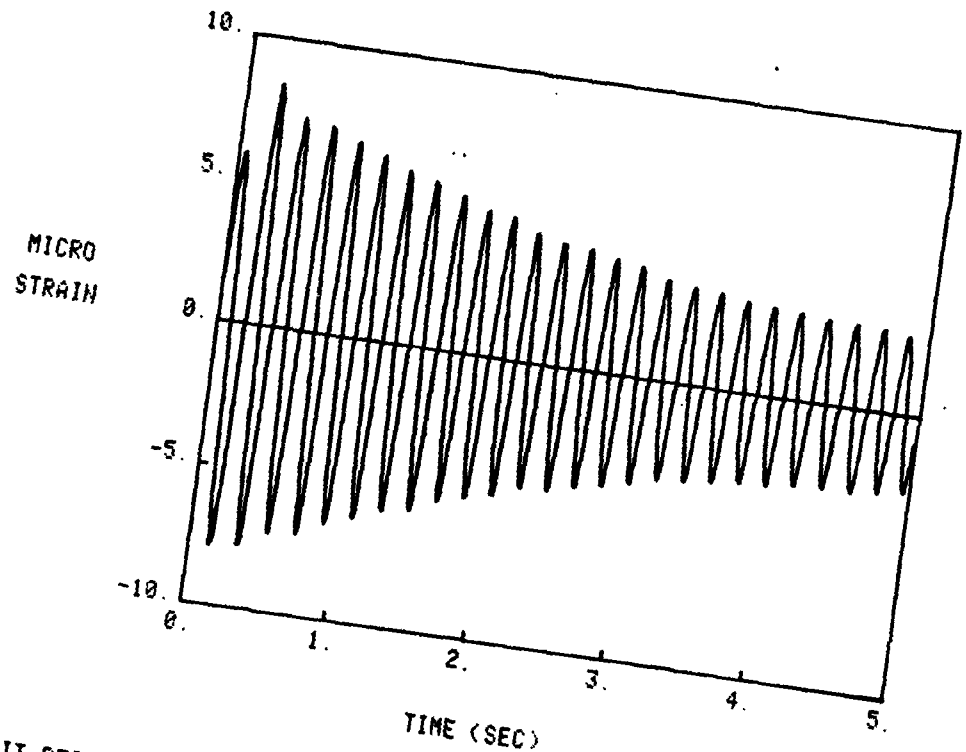


Figure 22 Optional Graphics Output: Typical Time History and FFT Spectrum

INPUT SIGNATURE USED FOR MCF FROM CHANNEL 1 RUN 588



CURVE FIT RESULT FOR RUN NO. 588, CHANNEL 1

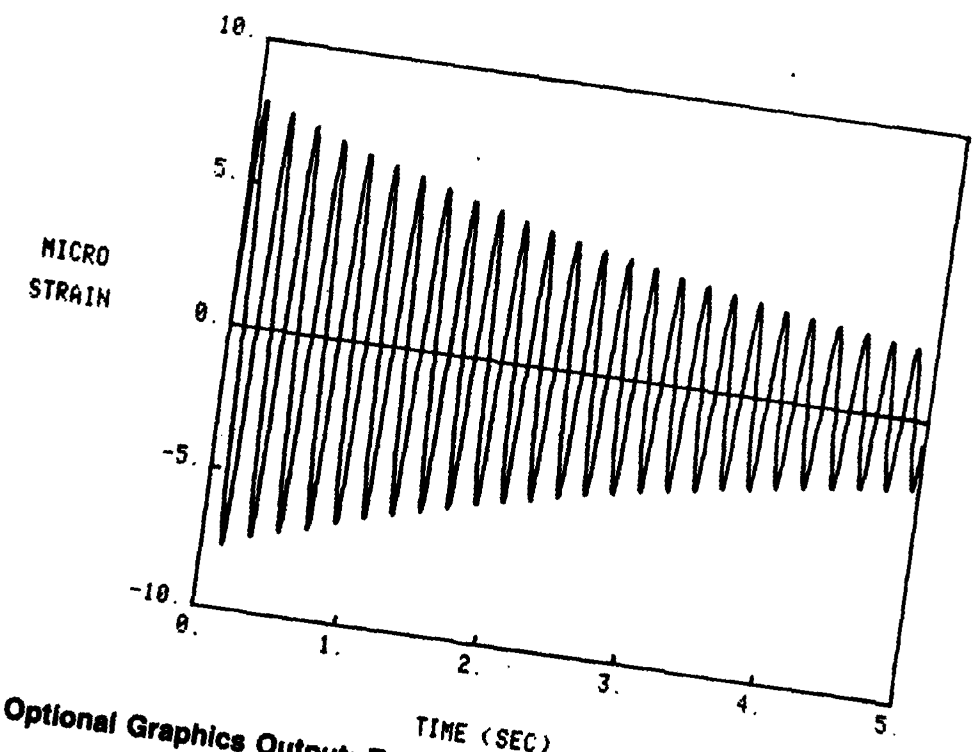
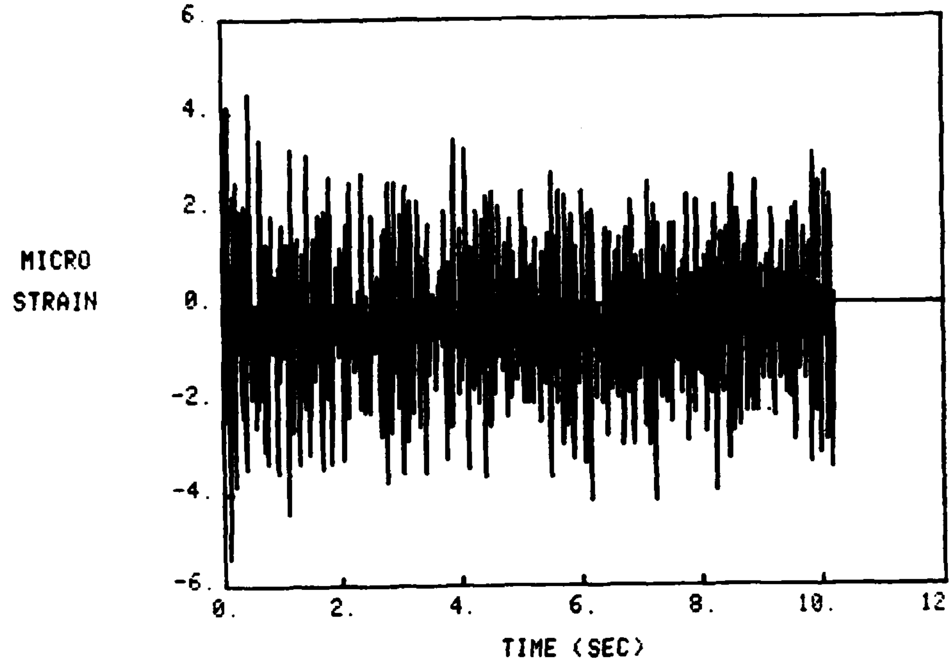


Figure 23 Optional Graphics Output: Typical Filtered Time History and Curve Fit Result

88-4-71-19

RUN=588, CHANNEL= 5, DATE= 608, MODE= 1, VACUUM= 0, RPM= 0
SAMPLING RATE 100. PITCH= 0, PRECONE= 0, DROOP= 0



FFT MAGNITUDE FOR RUN NO 588, CHANNEL 5

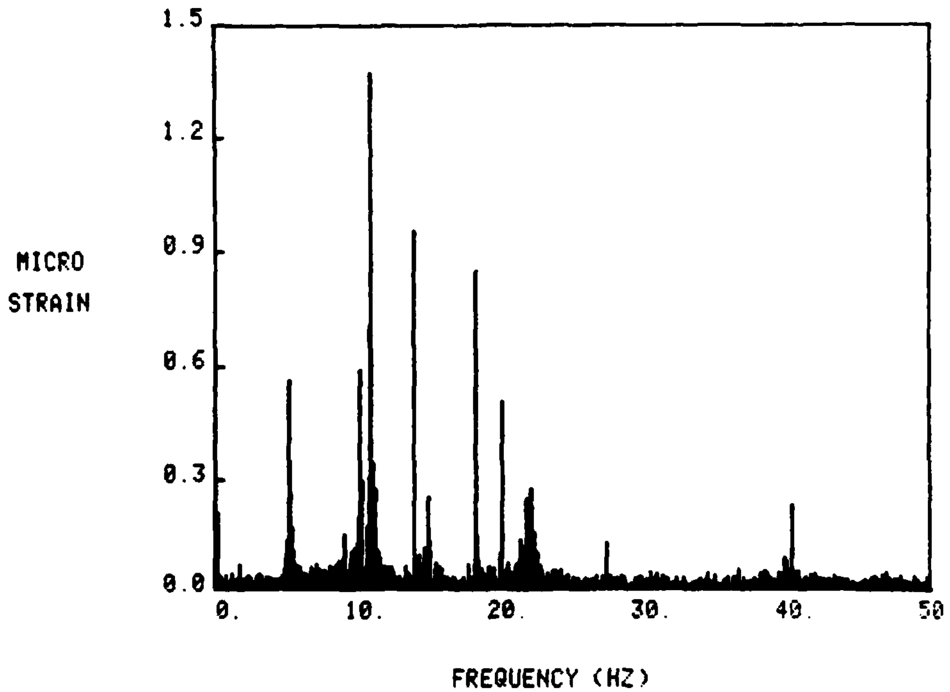


Figure 24 Extraction of Modal Information from a Time History Containing Noise

86-4-71-20

```
ATLAS TAPE DUMP
            SYSLIST                  MODLIST                  FILE NO.      2
 1    RUN              588     ITR               1      MCU STAT     19975
 2    POINT              1     VACUUM            0      STATCODE         2
 3    TIME             929     VIBMODE           1       (READY)        10
 4    DATE             608     RPM               0      DUALMODE         0
 5    PROJECT            0     EXCITE           58      TIMEBASE        14
 6    TAPE               4     PITCH             0        A (HZ)       100
 7    MAX CHAN          13     PRECONE           0      TIMEBASE         7
 8    TRIGGER            3     DROOP             0        B (HZ)     20000
 9    MEM SIZE        1024     FLEXURE           1
10    MCU STAT      -12793     THUMWEEL          0
11    MUX LIST           1     SPARE             0
12    MUX POSN           1     SPARE             0
13    MUX STRT           1     SPARE             0
14    MUX END            1     SPARE             0
15    CAL MODE           2     SPARE             0
16    CAL FLAG           0     SPARE             0
17    SPARE              0     SPARE             0
18    SPARE              0     SPARE             0
19    SPARE              0     SPARE             0
20    SPARE              0     SPARE             0

FILE  2   CHANNEL      1     10 WORDS READ    MUX   0      20 CALIBRATION INTEGERS
 1    MAX.STD.        10     11  OFFSET           0    CHANSTAT             53
 2    CHN.STAT        53     12  FILTER        5000    BIT 654               3
 3    FS IN MV        32     13  SPARE            0    ACDC                  1
 4    +FUL SCL       216     14  SPARE            0     OFF SET              1
 5     +FS/2         111     15  SPARE            0    OVERLOAD              0
 6      ZERO           6     16  SPARE            0    ATTNUATE            100
 7     -FS/2         -98     17  SPARE            0    SCALE      1.00000E+00
 8    -FUL SCL      -203     18  SPARE            0    ZERO       0.00000E+00
 9    SPARE          -73     19  SPARE            0    SLOPE      1.52817E-04
10     GAIN          128     20  SPARE            0    INTRCEPT-9.78030E-04

FILE  2   CHANNEL      2     10 WORDS READ    MUX   0      20 CALIBRATION INTEGERS
 1    MAX.STD.        10     11  OFFSET           0    CHANSTAT             53
 2    CHN.STAT        53     12  FILTER        5000    BIT 654               3
 3    FS IN MV        32     13  SPARE            0    ACDC                  1
 4    +FUL SCL       213     14  SPARE            0     OFF SET              1
 5     +FS/2         109     15  SPARE            0    OVERLOAD              0
 6      ZERO           4     16  SPARE            0    ATTNUATE            100
 7     -FS/2        -101     17  SPARE            0    SCALE      1.00000E+00
 8    -FUL SCL      -206     18  SPARE            0    ZERO       0.00000E+00
 9    SPARE          -73     19  SPARE            0    SLOPE      1.52671E-04
10     GAIN          128     20  SPARE            0    INTRCEPT-5.80151E-04

FILE  2   CHANNEL      3     10 WORDS READ    MUX   0      20 CALIBRATION INTEGERS
 1    MAX.STD.        10     11  OFFSET           0    CHANSTAT             53
 2    CHN.STAT        53     12  FILTER        5000    BIT 654               3
 3    FS IN MV        32     13  SPARE            0    ACDC                  1
 4    +FUL SCL       214     14  SPARE            0     OFF SET              1
 5     +FS/2         109     15  SPARE            0    OVERLOAD              0
 6      ZERO           4     16  SPARE            0    ATTNUATE            100
 7     -FS/2        -100     17  SPARE            0    SCALE      1.00000E+00
 8    -FUL SCL      -205     18  SPARE            0    ZERO       0.00000E+00
 9    SPARE          -73     19  SPARE            0    SLOPE      1.52817E-04
10     GAIN          128     20  SPARE            0    INTRCEPT-6.72396E-04

FILE  2   CHANNEL      4     10 WORDS READ    MUX   0      20 CALIBRATION INTEGERS
 1    MAX.STD.        10     11  OFFSET           0    CHANSTAT             53
 2    CHN.STAT        53     12  FILTER        5000    BIT 654               3
 3    FS IN MV        32     13  SPARE            0    ACDC                  1
 4    +FUL SCL       218     14  SPARE            0     OFF SET              1
 5     +FS/2         113     15  SPARE            0    OVERLOAD              0
 6      ZERO           8     16  SPARE            0    ATTNUATE            100
 7     -FS/2         -96     17  SPARE            0    SCALE      1.00000E+00
 8    -FUL SCL      -200     18  SPARE            0    ZERO       0.00000E+00
 9    SPARE          -73     19  SPARE            0    SLOPE      1.53109E-04
10     GAIN          128     20  SPARE            0    INTRCEPT-1.31674E-03

FILE  2   CHANNEL      5     10 WORDS READ    MUX   0      20 CALIBRATION INTEGERS
 1    MAX.STD.        10     11  OFFSET           0    CHANSTAT             53
 2    CHN.STAT        53     12  FILTER        5000    BIT 654               3
```

Figure 25 Optional Tabulated Output: ATLAS Tape Dump

```
** FOR CHANNEL   1, BANDPASS FILTER USED IS FROM    3. TO    7. HZ

        INPUT SIGNATURE LENGTH (FROM   1 TO  400 ) =     400
        NO. OF ITERATION =          6
        NORMALIZED STD. DEVIATION =      0.720131E-01

       *-*-*-*-*-*  RESULTING PARAMETERS  *-*-*-*-*-*
                    FOR CHANNEL  1 RUN  588
        Y=EXP(ZN*A2)*[A1*SIN(ZN*A3)+A4*COS(ZN*A3)]

     MODE     NATURAL FREQ     DAMPING     AMPLITUDE     PHASE
                  (HZ)           (%)       (MU-STRN)     (DEG)

      1           5.20         -0.780       8.0800       94.46


** FOR CHANNEL   2, BANDPASS FILTER USED IS FROM    3. TO    7. HZ

     RESULTS OF MODAL INTERPOLATION FOR CHANNEL  2

      FREQ        AMPL        PHASE
      (HZ)     (MCR-STRN)     (DEG)

      5.20        5.21        96.30


** FOR CHANNEL   3, BANDPASS FILTER USED IS FROM    3. TO    7. HZ


*** SUMMARY OF MODAL ANALYSIS FOR RUN  588 ***

   CHANNEL   FREQUENCY     DAMPING      SHAP-AMP      SHAP-PHS
               (HZ)          (%)       (MCR-STRN)     (DEGREE)

      1     0.5197E+01   0.7797E+00   0.1000E+01   0.0000E+00
      2                               0.7254E+00   0.0000E+00
      3                               0.3690E+00   0.0000E+00
      4                               0.1296E+00   0.0000E+00
      5                               0.1478E+00   0.1800E+03
      6                               0.4315E-01   0.1800E+03
      8                               0.8798E+00   0.0000E+00
      9                               0.3980E+00   0.0000E+00
     10                               0.9688E-01   0.1800E+03
```

Figure 26 Optional Tabulated Output: Example of Curve Fit and Interpolation Details and Results

TABLE RESULT OF MODAL ANALYSIS FOR ITR DATA

ROTOR CONF: (P= 0, C= 0, D= 0, FLEX=)

MODE= 1F, RPM= 0

FREQUENCY= 5.19 HZ (BLADE 8)

FREQUENCY= 5.35 HZ (BLADE 5)

DAMPING= 0.79 %

RECORD NO. 588 MUX 1 (BLD 8)			RECORD NO. 589 MUX 2 (BLD 8)			RECORD NO. 590 MUX 3 (BLD 8)			RECORD NO. 590 MUX 3 (BLD 5)		
SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)	SG#	AMP (MU-STRN)	PHS (DEG)
1	1.000	0.0	1	1.000	0.0	1	1.000	0.0	-	0.000	0.0
2	0.725	0.0	11	0.468	0.0	-	0.000	0.0	-	0.000	0.0
3	0.369	0.0	13	0.077	180.0	-	0.000	0.0	5	0.221	141.0
4	0.130	0.0	14	0.055	0.0	-	0.000	0.0	8	1.018	0.0
5	0.149	180.0	5	0.150	180.0	5	0.146	180.0	-	0.000	0.0
6	0.043	180.0	15	0.031	180.0	-	0.000	0.0	9	0.165	0.0
7	0.000	0.0	16	0.000	0.0	-	0.000	0.0	10	0.217	141.0
8	0.880	0.0	-	0.000	0.0	-	0.000	0.0	-	0.000	0.0
9	0.398	0.0	9	0.270	53.1	9	0.399	0.0	-	0.000	0.0
10	0.097	180.0	12	0.223	0.0	-	0.000	0.0	1	1.000	0.0
A. NORMALIZATION FACTOR											
1	8.080	94.5	1	8.609	92.4	1	8.039	-87.9	1	7.570	-48.9

B. AMP=0.0 IMPLIES EITHER NO SIGNATURE OR NO MODAL INFO AVAILABLE.

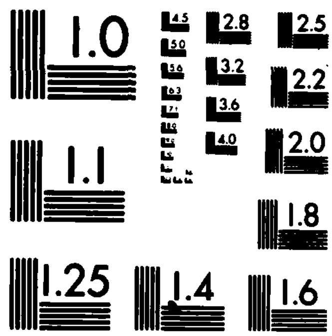
Figure 27 Example of Data Reduction Program Tabulated Output

```
588    1   9   0.51965010E+01   0.77969010E+00   0.80800280E+01   0.94461400E+02
  1   0.10000000E+01   0.00000000E+00
  2   0.72537880E+00   0.00000000E+00
  3   0.36901810E+00   0.00000000E+00
  4   0.12963150E+00   0.00000000E+00
  5   0.14776670E+00   0.18000000E+03
  6   0.43145430E-01   0.18000000E+03
  8   0.87978580E+00   0.00000000E+00
  9   0.39797070E+00   0.00000000E+00
 10   0.96876440E-01   0.18000000E+03
589    2   9   0.51890980E+01   0.79928310E+00   0.86087200E+01   0.92405790E+02
  1   0.10000000E+01   0.00000000E+00
  2   0.46787720E+00   0.00000000E+00
  3   0.76599420E-01   0.18000000E+03
  4   0.54706930E-01   0.00000000E+00
  5   0.14970650E+00   0.18000000E+03
  6   0.30952350E-01   0.18000000E+03
  7   0.10145080E-01   -.41358410E+02
  9   0.26970250E+00   0.53116060E+02
 10   0.22344550E+00   0.00000000E+00
590    3   8   0.51870760E+01   0.79562910E+00   0.80387240E+01   -.87903490E+02
  1   0.10000000E+01   0.00000000E+00
  3   0.20789360E+00   0.18000000E+03
  4   0.95873360E+00   0.38452000E+02
  5   0.14649050E+00   0.18000000E+03
  6   0.15521410E+00   0.37298510E+02
  7   0.20469720E+00   0.18000000E+03
  9   0.39888230E+00   0.00000000E+00
 10   0.94171850E+00   0.39008500E+02
591    1  10   0.32207760E+02   0.47451220E+00   0.10176510E+02   -.16012940E+02
  1   0.10000000E+01   0.00000000E+00
  2   0.14523400E+00   0.39771480E+02
  3   0.12210590E+01   0.14319240E+03
  4   0.64977750E+00   0.18000000E+03
  5   0.26841010E+00   0.13706240E+03
  6   0.11050210E-01   0.16106490E+03
  7   -.79291640E-01   0.42577900E+02
  8   0.82921790E+00   0.00000000E+00
  9   0.31120950E+00   0.35635730E+02
 10   0.15371820E+00   -.13833830E+03
592    2   6   0.32205260E+02   0.48710990E+00   0.10874500E+02   0.24023180E+02
  1   0.10000000E+01   0.00000000E+00
  2   0.54119600E+00   0.18000000E+03
  3   0.12003020E+00   0.30488530E+02
  4   0.42771540E+00   -.14302870E+03
  9   0.32523760E+00   0.32479520E+02
 10   0.54370650E+00   0.14181940E+03
593    3   8   0.32198330E+02   0.50075270E+00   0.10851680E+02   0.25763660E+02
  1   0.10000000E+01   0.00000000E+00
  3   0.54608400E-01   -.21806460E+02
  4   0.38333470E+00   0.18000000E+03
  5   0.24911920E+00   -.14044490E+03
  6   0.48166280E-01   0.18000000E+03
  7   0.85405530E-01   0.00000000E+00
  8   0.32120970E+00   0.36065770E+02
 10   0.36300620E+00   0.18000000E+03
```

Figure 28 Format of Processed Results on Tape

AD-A172 131 AN EXPERIMENTAL INVESTIGATION OF THE STRUCTURAL DYNAMICS OF A TORSIONALLY..(U) UNITED TECHNOLOGIES RESEARCH CENTER EAST HARTFORD CT A V SRINIVASAN ET AL. 2/2

UNCLASSIFIED JUL 86 UTRC/R86-956877-19 NASA-CR-177418 F/G 20/4 NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
NASA CR-177418	ADA172131	

4. Title and Subtitle	5. Report Date
An Experimental Investigation of the Structural Dynamics of a Torsionally Soft Rotor in Vacuum. Final Technical Report	July 1986
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
A. V. Srinivasan, D. G. Cutts and H. T. Shu	UTRC R86-956877-19
	10. Work Unit No.
9. Performing Organization Name and Address	11. Contract or Grant No.
United Technologies Research Center Silver Lane East Hartford, CT 06108	NAS2-11942
12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
National Aeronautics and Space Administration Washington, D.C. 20546	Contractor Report June 1984 - June 1986
	14. Sponsoring Agency Code

15. Supplementary Notes

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16. Abstract

An extensive data base of structural dynamic characteristics has been generated from an experimental program conducted on a torsionally soft two-bladed model helicopter rotor system. Measurements of vibratory strains for five modes of vibration were made at twenty-one locations on the two blades at speeds varying from 0 to 1000 RPM and for several combinations of precone, droop and flexure stiffness. The tests were conducted in vacuum under carefully controlled laboratory conditions using a unique excitation device which uses a system of piezoelectric crystals bonded to the blade surface at the root. Frequencies, strain mode shapes and damping are deduced from the data and can be used to calibrate structural dynamics codes. The dynamics of the system is such that there is a clear tendency for the first torsion and second flap modes to couple around 800 RPM. The resulting mode shapes are complex and contain mixtures of bending and torsion strains. Strain mode shapes at speed are significantly different and this feature can be important in the calculation of aeroelastic instabilities. The tension axis tests confirmed that the modulus-weighted centroid for the nonhomogeneous airfoil is slightly off of the geometric centroid and validated previous static tests performed to determine the location of the tension axis.

17. Key Words (Suggested by Author(s))	18. Distribution Statement
Model helicopter rotor, hingeless blades, pitch flexures, test, evacuated, structural dynamic characteristics, piezoelectric crystal excitation strain mode shapes, tension axis location.	Unclassified - Unlimited Subject Category 01

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price*
Unclassified	Unclassified	95	

*For sale by the National Technical Information Service, Springfield, Virginia 22161

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10-86

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